A MANUAL

OF

INDIAN TIMBERS

AN ACCOUNT OF THE GROWTH, DISTRIBUTION, AND USES OF THE TREES AND SHRUBS OF INDIA AND CEYLON

WITH

DESCRIPTIONS OF THEIR WOOD-STRUCTURE

BY

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FOREST OF LONG-LEAVED PINE. TONS VALLEY, N.-W. HIMALAYA.

(*Photograph by F. Gleadow.*)

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INTRODUCTION

In the Introduction to the former edition of this work, published in 1881, a full explanation was given of the circumstances under which its preparation came to be undertaken. The Government of India had prepared for the Paris International Exhibition of 1878 a very fine collection of Indian woods and forest products. The work of collection and preparation had been done in the office of the Inspector-General of Forests, at that time Mr. (now Sir Dietrich) Brandis, and as Assistant to the Inspector-General, I had executive charge of it. My own interest in the study of woods and wood-structure had been excited while I was a student in 1869 to 1871 at the National School of Forestry at Nancy in France, where I had the advantage of listening to the lectures of the Professor of Natural History, Mons. A. Mathieu, author of the "Flore Forestière de la France"; and where I became greatly interested in the collection of wood-specimens arranged in the museum attached to the school. The work carried on in 1877 and 1878 at Simla and Calcutta was therefore to me a labour of love. Several sets of the wood-specimens were prepared: the chief set was sent to Paris, other sets were distributed to the chief Indian Forest offices, to the museum of the Royal Gardens at Kew, and to a few similar institutions in Europe and America; while a special set was reserved for the museum of the Imperial Forest School at Dehra Dún, which had then been just opened. The special Dehra Dún set was retained for a time in the office of the Inspector-General, and it was arranged that it should be first utilized for the preparation of descriptions of the woods it contained.

The descriptions were prepared by a committee consisting of Sir D. Brandis, myself, and a second Assistant, Mr. A. Smythies, B.A. To the Dehra Dún collection many additional specimens were contributed, among which were chiefly noticeable Dr. N. Wallich's valuable collection made in 1828, Dr. Griffith's collection of 1836, Sir D. Brandis' collections made in Burma, Berar and elsewhere, my own private collections, chiefly made in the Darjeeling Hills and Terai, the collections made by Mr. Sulpiz Kurz, Curator of the Herbarium of the Royal Botanic Garden, Calcutta, those contributed by Col. Ford, M.S.C., then Superintendent of Port Blair, and a large collection

from the Royal Botanic Garden, Calcutta, made available through the good offices of Dr. (now Sir George) King, the Superintendent. The wood-descriptions then made were afterwards arranged by myself, and, with the addition of information on distribution, uses, etc., were published by the Government of India.

From that time, until my final retirement from the service in 1899, I have steadily collected further specimens in the forest circles of which I have held charge, in Bengal, Madras, and the North-Western Provinces; and many other specimens have been received from forest officers in other parts of India. These specimens are all deposited either in the museum of the Imperial Forest School, or in the special collections in Bengal or Madras, and the numbering has been continued on the same plan as before. For the purpose of this new edition of the work, the whole of the wood-descriptions originally made have been revised as far as possible, and new ones have been incorporated, by myself; and, so far as I have been able to ascertain them, the names of the officers who contributed specimens either to the original collection or subsequently, have been inserted in the list accompanying each species described. In some cases (the original receipt book having been, most unfortunately, lost) I have had either to depend on memory only, or to leave the name blank, and this explanation will, I hope, be taken as sufficient apology for errors or omissions. And here I think it right to say that I am only too conscious of the inequality of the descriptive work. I have tried to make my descriptions uniform and easily comparable, but the fact that the specimens have not been all available for comparison at the same place, has made it necessary for me to leave some of them as they were written, instead of revising them all and treating the Orders and genera fully as groups.

The want of a handbook of Indian trees is one that began to make itself felt very soon after the formation of the Forest Department in India. When I arrived in India in 1871, our standard work of reference was Dr. E. Balfour's "Timber Trees," a most useful (indeed, at that time, invaluable) work, of which three successive editions were published, in 1858, 1862 and 1870. In it were incorporated all the various items of information obtainable from many previous publications, the list of which, given in the third edition, forms a guide to the literature of Indian forest economic knowledge up to 1870. Shortly after that time, the special Forest Floras began to appear: Col. Beddome's "Flora Sylvatica of Madras (and Ceylon)" in 1869 to 1874; Mr. S. Kurz' "Forest Flora of Burma" in 1877; and, most important of all, Sir D. Brandis' "Forest Flora of North-West and Central India" in 1874. Dalzell and Gibson's "Bombay Flora," published in 1861, to some extent provided for Bombay; and consequently, only Bengal and Assam remained unprovided for, representing, however, a region of great forest richness. The "Flora of British India," by Sir J. D. Hooker, G.C.S.I., etc., began to appear in May, 1872, and its gradual publication lasted until 1897. When the first edition of the "Manual of Indian Timbers" was published, the "Flora of British India" had only completed its second volume, *i.e.* to the end of CALYCIFLORÆ; consequently, all after the order of the *Cornaceæ* required to be brought into line with that standard authoritative work. This has

been done, and in this new edition the arrangement and nomenclature of the "Flora of British India" have been adopted throughout, except where revisions and new descriptions by recent writers have necessitated alterations being made.

The question of what works should be quoted was a difficult one, but after much consideration, I decided to quote regularly the following:—

(1) The "Flora of British India," by Sir J. D. Hooker.
(2) The "Flora Indica" of Dr. Roxburgh.
(3) The "Flora Sylvatica of the Madras Presidency," by Col. R. Beddome.
(4) The "Forest Flora of North-West and Central India," by Sir D. Brandis.
(5) The "Forest Flora of British Burma," by Mr. S. Kurz.
(6) The "List of Trees, Shrubs, and Large Climbers of the Darjeeling District, Bengal," by myself. Second edition. 1896.
(7) The "Systematic List of Trees, Shrubs, etc., of the Bombay Presidency," by Mr. W. A. Talbot.
(8) The "Handbook of the Flora of Ceylon," by Dr. H. Trimen and Sir J. D. Hooker.

Other works are, however, referred to when specially necessary. Considering that the "Flora of British India" is usually available in Forest offices for reference, it might have been, perhaps, possible to dispense with quoting some of the above, and more particularly Roxburgh's "Flora Indica." Roxburgh's names are, however, those given in many old books and papers, and they are therefore frequently met with; while not to have quoted Roxburgh would to myself have been a matter of regret, for in the early part of my Indian service, after the publication of Mr. C. B. Clarke's useful edition, almost all my own botanical work had to be done with the aid of Roxburgh, and I naturally consider the book as an old friend. The "Flora of the Presidency of Bombay," by Dr. Theodore Cooke, C.I.E., is only just beginning to issue, only two parts being yet out, so I am unable to quote it, and I quote Mr. Talbot's work instead. Babu Upendranath Kanjilal's useful "Forest Flora of the School Circle" has also appeared too late to be regularly referred to. But Sir George King's "Monographs of the Magnoliaceæ and Anonaceæ," in the *Annals of the Royal Botanic Garden of Calcutta*, his "Contributions to a Flora of the Malay Peninsula" in the *Journal of the Asiatic Society of Bengal*, and various other species described by him in those publications, have been quoted wherever advisable; some Leguminosæ, and other new contributions made by Major D. Prain, I.M.S., have been incorporated; Sir D. Brandis' Dipterocarpeæ, published in vol. xxxi. of the *Journal of the Linnean Society*, have been quoted; new species from Upper Burma, described by Sir H. Collett and Mr. Hemsley in the *Journal of the Linnean Society*, vol. xxviii., and those published in the *Journal of the Bombay Natural History Society*, by Mr. Bourdillon and Mr. Talbot, have been added. In cases where my own investigations have led me to think new species advisable or alterations necessary, I have not attempted to bring them in, because I thought that it would be best to await the publication of proper botanical descriptions.

As regards vernacular names, I have inserted almost all those that I have come across in the various works connected with Forestry which I have been able to consult and that I or other Forest officers have collected. For their accuracy I can give no guarantee; and for the correctness or otherwise of the spelling I cannot be responsible for no one person can be expected to know all the Indian languages sufficiently well to be able to correct the lists. Of course, many more names might have been added from Dr. Forbes Watson's Index, from the "Flora Andhrica" of Sir Walter Elliott, from Dr. Watt's Dictionary, and from other works, but I have thought it best to take only those given in Forest works of reference and Forest Lists. The Burmese names have all been carefully corrected by Mr. J. W. Oliver, and Mr. Caccia has kindly compared the Lepcha names with those given in Col. Mainwaring's Dictionary, though, after consideration, I have thought it better to adhere to the spelling given in my Darjeeling List, instead of making an alteration which might have been confusing.

In this place, I think it right again once more to caution Forest officers against the practice of adopting the scientific names given as equivalents of vernacular words. That caution has been many times repeated; and perhaps nowhere has the subject been more fully discussed than in the preface to the second edition of Balfour's "Timber Trees," where the author gives his own experience as well as that of the botanists Drs. Wight and Arnott. To a Forest officer with some knowledge of botany and capable of verifying descriptions, a vernacular name may often be useful as helping him to trace quickly the scientific name of a plant met with; but to adopt scientific equivalents blindly merely on the strength of a vernacular name given by an often inaccurate native, is a practice which may lead, and to my own knowledge often has led, to absurd mistakes. I have myself made many lists of the vernacular names used in different places or by different tribes, and I know only too well how hard it is to make sure that those given are the right ones. Any native asked for a name thinks it a point of honour to give one, and, if he does not know the correct one, has no compunction in manufacturing one for the occasion. The vernacular nomenclature in the Himalaya is most puzzling, almost every valley having different names for even well-known common trees; it is much the same where one of the chief Indian languages is spoken over a considerable area, as is the case with Hindustani, Bengali, Maráthi, Telugu, and Tamil. Among less-known languages, such as those spoken in the Gondwána region, where dialects like Gondi, Kurku, Sonthal, Mal Pahari, Kharwar, Oraon, Bhumij, Kól, Khond, Saura, Reddi, Koya and others are used, the names are probably more accurate and more uniform. But in all cases, the names given must be accepted and used with great caution, and the plants must be verified botanically at the earliest opportunity.

It may be useful to mention here the geographical position of some of the tribes whose vernacular names for trees are quoted. For the North-West Himalaya, the names are chiefly those collected by J. L. Stewart and Brandis, and are given for different regions or river valleys; *e.g.* Kashmir, Ladak, Lahoul, Kulu, Sutlej, Kunawar, Jaunsar, Garhwal, Kumaon, Dehra Dún. For the Central Himalaya are

quoted Nepal names, mostly collected by Wallich or by myself in Darjeeling. For the Eastern Himalaya are quoted the names given by Lepchas, Tibetans, Bhutanese, Daphla, Mishmi and other tribes; while those used by the Mechis and Gáros, tribes of the forests at the base of the hills, are also inserted. For Assam (besides Assamese), Khasia, Jaintia, Naga, Manipuri and Cachari names are given, where known; and for Eastern Bengal, those of Tippera and the Magh, Chakma and Lushai tribes of Chittagong. In Central India come the Gondwána tribes already referred to, with the Uriyas and Telugu-speakers on the east, and the Guzerati and Marathi peoples on the west. In South India, the chief languages for which vernacular names are quoted are Telugu, Kanarese, Tamil, Malayalam, while some of the names given by Badaga, Kurumber and other Nilgiri tribes, or by Kaders, Mulsers and others in the Western Ghâts are also given where available. In addition to Burmese and Andamanese names, a few Karen, Shan, Kachin and others are also given.

The letters prefixed to the numbers of specimens quoted, denote the forest region from whence they come. I should have liked to have revised the boundaries of these regions, but as the old letters are to be found on so many widely distributed specimens, this would have caused confusion, so I have decided to adhere to them. They are—

H. The West Himalaya, comprising the mountains of that range from the Indus to the Sardah river on the Nepal frontier.

P. The dry region of the Punjab, Rajputana and Sind, with Baluchistan.

O. The plains and sub-Himalayan tract of the North-Western Provinces, Oudh and Gorakhpur (now called "United Provinces").

C. Central India, the country lying south of the Jumna and north of the Godavery River, and including the Vindhia and Satpura Hills, as well as Orissa and the Circars on the east, Khandésh and Guzerat on the west.

E. The East Himalaya from Nepal eastwards, the Khasia Hills, Assam, Cachar, Chittagong and the Sundarbans.

D. The Deccan and Carnatic, comprising the country to the south of the Godavery, and chiefly included in Madras and Mysore.

W. The West Coast of the Peninsula, comprising the Western Ghâts and the country lying between them and the sea.

B. Burma, including the Andaman Islands.

No letter has been given for Ceylon, the forest trees of which I have included at the special request of Ceylon Forest officers.

In the region "H" come the great forests of coniferous trees of the West Himalaya. In these, the most important tree is the deodar, and with it are found three pines, two silver firs, the spruce, cypress and yew; as well as broad-leaved trees, among which the most conspicuous are oaks, birch, alder, walnut, maple, elm, hornbeam, poplar, willow, hazel, holly, box, horse-chestnut and others usually of different species from, though of the same genera as, the chief trees of Europe. Lower down are forests in which laurels, *Cedrela*, *Celtis*, *Albizzia*, *Olea*, *Meliosma* occur, passing gradually into the forests of the lower hills and plains. In this region palms are scarce, but canes and wild

dates are occasionally found, and in the eastern portion, *Trachycarpus Martiana* and *Wallichia* occur. The more valuable of these forests, those of deodar, are worked for the supply of the Indian railways, while the other pines are used for building purposes in the plains, the extraction being chiefly by water.

In the region "P," the chief trees of note are species of *Acacia*, *Prosopis*, *Capparis*, *Salvadora*, *Tamarix*, *Populus euphratica*. These form what are known as the "rukhs" of the Punjab and the river-side forests of Sind. In this region also come the forests of Baluchistan, in which the chief trees of value are *Juniperus macropoda*, *Pistacia*, *Olea*, etc., with tracts of the small gregarious palm *Nannorhops*. The forests are all worked for country supply.

In the region "O," the chief and most important forests are those of Sál (*Shorea robusta*), a gregarious tree of great importance, which is found mixed with species of *Terminalia*, *Lagerströmia*, *Bombax*, *Careya*, *Schleichera*, *Adina*, *Eugenia*, *Anogeissus*, *Stereospermum*, *Garuga*, *Odina*, figs and many others. The Sál forests affect chiefly what is known as the Bhabar tract on a soil of sand and gravel. Where the soil is deep and moist, Sál disappears, and the mixed forest which replaces it includes *Albizzia*, *Acacia* and *Dalbergia*. Along river-banks are found gregarious forests of *Acacia* and *Dalbergia*, and in swampy places such trees as *Cedrela Toona*, *Trewia nudiflora*, *Diospyros Embryopteris* and *Pterospermum acerifolium*. On lower Himalayan spurs and in the outer range known as the Siwaliks, the Sál and its usual accompaniments are found, with Chir pine on the higher points. *Calamus tenuis*, a rattan, and three species of date (*Phœnix*) represent the palms; *Dendrocalamus strictus* the bamboos. All these forests are worked for country supply, only a small proportion of the Sál and Sissu wood being utilized in railway construction and other public works.

The region "C" is that of the great deciduous dry forest of India, which extends over the whole of the region and passes northwards into "O" and southwards into "D." This is the forest area which in the Central Provinces, in Chota Nagpore, Orissa and the Circars on the east, in Khandésh and Guzerat on the west, is chiefly worked for country supply, affording but little timber even for railway purposes, the chief trees so used being the Teak and Sál. In the western part of the region, Teak is the chief tree; in the eastern part, Sál; the chief other genera found being *Pterocarpus*, *Hardwickia*, *Chloroxylon*, *Terminalia*, *Xylia*, *Lagerströmia*, *Anogeissus*, *Adina*, *Stephegyne*, *Diospyros*, *Eugenia*, *Stereospermum*, *Dalbergia*, *Acacia*, *Albizzia*, *Ougeinia*, *Bassia*, *Schleichera*, *Boswellia*, *Sterculia*, *Zizyphus*, *Bombax*, with two bamboos, the deciduous *Dendrocalamus strictus* on dry slopes and the thorny evergreen *Bambusa arundinacea* in valleys and damp places. Along river-banks *Terminalia Arjuna*, *Anogeissus acuminata*, *Pongamia*, and *Eugenia* are most noticeable. In ravines, the *Caryota* palm and tree-ferns are occasionally found, with the wild mango.

Region "E" is a vast region with a great variety of kinds of forest and a great number of species of Forest trees. In the higher Eastern Himalaya are forests of fir (silver fir, spruce, larch, yew,

juniper, and hemlock spruce). These pass gradually downwards into forests of rhododendron mixed with oaks and chestnuts, and as one descends one meets with large species of maple, laurels, magnolias, *Elæocarpus*, *Echinocarpus*, *Bucklandia*, *Nyssa*, with several species of small bamboos, tree-ferns and canes. Lower down appear large trees of *Cedrela*, *Terminalia*, *Duabanga*, *Canarium*, etc., with palms of the genera *Caryota*, *Livistona*, *Phœnix*, *Didymosperma*, and the large screw-pine *Pandanus furcatus*; and these again pass into Sál forest with similar accompanying species to those mentioned under region "O," but with the addition of *Schima Wallichii* and *Dillenia*. These Sál forests, which extend across the Brahmaputra to the Gáro Hills, produce fine trees and a good deal of timber for export to the plains. Much wood is consumed for various purposes on the tea estates, and for local native requirements. In the sub-Himalayan tract, Sál forests are the chief ones met with; Khair and Sissu forests are found along the river-banks, and occasional swampy cane-brakes occur. The chief bamboo is the thin-walled straggling *Dendrocalamus Hamiltonii*. In the upper parts of the Assam valley, *Mesua ferrea* is common with a great variety of other species, among which *Shorea assamica*, *Cedrela*, *Chickrassia*, *Magnolia*, *Michelia*, *Dillenia*, *Anthocephalus*, and the wild tea plant are noticeable. The forests of the Khasia Hills are chiefly remarkable for containing many species of oak. Passing southwards from Northern Bengal, the Assam Valley and the Khasia Hills, we come to the great forest region which extends from the valley of Cachar southwards down the Lushai Hills to the border of Arracan and eastwards to the boundaries of Burma, still more or less undefined. In this great region is a vast forest with giant trees on the alluvial lands along the rivers, and smaller growth with dense masses of the *Melocanna* bamboo on the hills. Prominent in what may be called the "Chittagong" forests are the *Dipterocarpus* trees with other giants, *Swintonia*, *Tetrameles*, *Chickrassia*; while valuable timbers are given by *Lagerströmia Flos-Reginæ*, *Dichopsis*, *Gmelina*, *Mesua*, *Cedrela*. An undergrowth of palms, such as *Livistona* and *Licuala*, provides strange foliage to mark the features of what are in all probability, with those of Tenasserim, the most really "tropical" of the forests in the Indian Empire. Finally, in Region "E" come the swamp forests of the Sundarbans, composed of interesting trees such as *Heritiera*, *Rhizophora*, *Bruguiera*, *Excæcaria*, *Sonneratia*, *Lumnitzera*, and *Avicennia*, and affording quantities of small building and industrial timber and fuel for the market of Calcutta. The scenery of the Sundarbans is also marked by a profusion of the *Nipa* palm and *Phœnix paludosa*.

Region "D" consists of the southern part of the Deccan plateau, the slopes of the plateau on the east and south and the Carnatic country. The forests of the plateau are deciduous forests of the type described under Region C, with perhaps more Teak, no Sál (though an allied species, *Shorea Tumbuggaia*, which resembles it, occurs in places), more *Hardwickia* and the appearance of several species which do not extend north. Among these species, two are especially noticeable: the Sandal tree which affects half-bare, stony forest lands

with occasional bushy growth, in Mysore and adjoining territories; and the Red Sanders, *Pterocarpus santalinus*, characteristic of the comparatively small forest areas known as the Seshachellam, Lankamalai, and Veligonda hills. In the Carnatic, the chief forest growth is that of "dry evergreen," the chief trees in which are the ebony, satinwood, *Mimusops, Strychnos, Pterospermum, Melia, Eugenia*, with a number of smaller species, chiefly valuable as fuel. In this region, too, are large tracts covered with the Palmyra palm, one of the most useful of Indian plants, its strong tough outside wood giving material for house-building, and its leaves, fruit, etc., other valuable products. Much of this region is unfortunately infested with prickly pear. It had been hoped that forest protection would do much in overshadowing and killing it out, but such hopes have, I am told, unfortunately not been fully realized. The forests of region "D" are almost exclusively worked for local supply, only sandal and a few fancy woods being exported with some tans, seeds and fibres.

In Region "W" come the forests of the mountain range of the Western Ghâts, with the lands between their base and the sea. In some places there are dry areas with a growth not unlike that of the deciduous forest of Central India and with a good deal of teak, but the greater part consists of hill forests on lower hill slopes, with evergreen forest growth of large trees, such as *Dalbergia latifolia, Xylia, Artocarpus, Pterocarpus, Lagerströmia, Terminalia, Vatica, Canarium, Cullenia, Polyalthia, Mesua*. Higher up, and especially in the hill ranges of the Nilgiris, Anamalais, Pulneys and Travancore mountains, these evergreen forests merge into what are known as "sholas," where the principal forest vegetation consists of *Eugenia, Michelia, Ilex, Hydnocarpus, Elæocarpus, Ternströmia, Gordonia, Symplocos, Rhododendrons* and Laurels, with an undergrowth of *Strobilanthes*, Rubiaceous shrubs and tree-ferns. In the forests of Region "W" the Teak is the chief tree, and is the chief timber of export. Blackwood (*Dalbergia latifolia*) is also an export wood, but the rest are mostly woods of local use and the forests are worked for local requirements. In the hill ranges also are many exotic plantations, chiefly of Australian *Eucalyptus* and *Acacia*, but also of various pines, cypress, etc., all of much local importance for fuel and to some extent for timber. In the coast tract the Talipat palm is conspicuous, and in the Ghât region are found *Bentinckia* and *Arenga Wightii*, with many canes. Many interesting bamboos are also found in Region "W," and among them are noticeable *Teinostachyum Wightii, Oxytenanthera Thwaitesii* and species of *Ochlandra*, with *Arundinaria Wightiana* on the higher hills.

Region "B" is, in a commercial sense, the most important of the regions described, as it contains the extensive and valuable forests of teak, the chief export timber of India and the chief source of revenue of the Indian forests. The vast area covered by Region "B" contains many classes of forest, which for Lower Burma have been excellently and fully described by Mr. S. Kurz in his "Forest Flora" and "Preliminary Report on the Vegetation of Pegu." The teak forests are deciduous forests, and occupy chiefly the slopes of

the hills known as Yomas and their extensions northwards. With teak are associated *Xylia*, *Terminalia*, *Lagerströmia*, *Acacia*, *Homalium*, *Eugenia*, and other genera, with bamboos such as *Bambusa polymorpha*, *Dendrocalamus strictus* and *Cephalostachyum pergracile*. Another class of Burmese deciduous forest is that known as "Eng forest," which contains chiefly *Dipterocarpus tuberculatus*, *Pentacme siamensis*, *Dillenia*, *Terminalia*, *Strychnos*, *Dalbergia cultrata*, and *Melanorrhœa usitata*, and is mostly met with on laterite formations. Forests of cutch (*Acacia Catechu*) are found sometimes nearly pure and of much value. The mixed forests, like those described under Regions E and W, contain a great quantity of species, many of which give valuable timbers. In the hills east of the Sittang river, and in those in Upper Burma, the forests rise to a considerable elevation and have a vegetation of their own, noticeable in which are the two pines *Pinus Kasya* and *P. Merkusii*, and in which also occur oaks, chestnuts, laurels, *Bucklandia*, *Myrica*, *Symplocos*, *Rhododendron*, and other trees similar to those of somewhat higher levels in the Eastern Himalaya. Finally, Burma has its own swamp forests, both littoral, resembling those of the Sundarbans already described, and freshwater. In the latter forests, which are curious and interesting, the chief trees are *Mangifera longipes*, *Xanthophyllum glaucum*, and *Anogeissus acuminata*.

The forests of the Andamans are chiefly of mixed trees, the chief being *Pterocarpus dalbergioides*, giving a wood which is now considerably exported for furniture purposes under the name of "Padauk," *Albizzia*, *Artocarpus*, *Podocarpus*, *Lagerströmia*, *Mimusops*, *Diospyros Kurzii* (the valuable marble-wood) and others.

Finally, there is the Ceylon region, which is perhaps better known than the adjoining Indian tracts. No letter has been given to Ceylon specimens, but, strictly speaking, none would be necessary, for the forests of the south-western part of the island, having a heavy rainfall, would come into "W," and those of the north-eastern part, which has a dry climate, into "D." The chief trees are species of DIPTEROCARPEÆ, with *Chloroxylon*, *Diospyros*, *Berrya*, *Pericopsis Mooniana*, *Mimusops*, the hill forests being "sholas" of the same character as those of S. India. The chief Ceylon specimens available were those issued in a small box and sold in Colombo by Messrs. Mendis. The old original set was a good one and fairly accurate, but I cannot say as much for the more recent ones, one of which I obtained in 1899 through the good offices of Mr. A. Broun. A number of specimens in the box were quite wrongly named, and some of the woods were nearly rotten and worthless.

This account of the forests of India is much too brief, but space is not here available for a longer one, which might easily be made to run to many pages. It suffices, however, to show the variety and extent of the resources of the Indian forests and the magnitude of the task which is imposed on the Indian Forest Department in properly managing its splendid estate for the benefit of the Indian people and the finances of the Indian Empire. And here it may be as well to explain that the area at present administered by the Forest Department in India amounts to nearly 118,000 square miles, of which

about 81,000 are "reserved" forests, that is, forests demarcated and legally settled as a permanent Government forest estate. The permanent forest area, it may be remarked, amounts only to about 8½ per cent. of the total area of British territory, 945,000 square miles. The *net* revenue, after paying all charges, is about £500,000, but it should be noted that this sum does not include the value of the very large quantity of produce which is supplied free to the people.

I regret the absence of a map. In the former edition, a map showing the Indian rainfall was inserted; since that edition was published better rainfall maps have been made available, as well as forest maps, in the "Statistical Atlas of India," which ought to be referred to. A map, to be of real use in showing forest regions, forest distribution, etc., would have to be of a rather unwieldy size and would be difficult to insert, so I have omitted the rainfall one, and would refer instead to the Atlas, which will probably be, from time to time, revised by the Government of India, and made available officially for consultation by nearly all those who are likely to use this work.

In the description of the woods, the chief characters of which note has been given are—

1. Size and appearance of tree and whether evergreen or deciduous; mode of branching.
2. Description of bark.
3. Description of wood, both sapwood and heartwood, with its colour, hardness, grain, scent, the characters of the annual rings, pores, and medullary rays, etc.

These characters require a short explanation.

1. The plants are usually described as "shrubs," "large shrubs," "small trees," "trees," "large trees," and "very large trees," according to general size; or as "climbing" or "straggling" plants. So far as is known, it is recorded whether they are evergreen or deciduous. The character of the bole and its branching is given wherever possible.

2. The *bark* is described according to its colour, which usually presents some shade of grey or brown, varying into white, or red, or black; its thickness, represented by the fractions of the inch; its roughness or smoothness, and the fissures and clefts into which it is cut externally; its texture whether hard or soft, papery or corky, etc.; and the way in which it exfoliates.

3. The *wood* is described whenever possible according to both sapwood and heartwood. The *colour* is given as nearly as possible according to the shades, usually of white or brown, but varying into red, grey, yellow, purple and black. The *scent* is recorded, should it happen that it presents any peculiarity worthy of note. The *hardness* is given according to the different categories as "extremely soft," "very soft," "soft," "moderately hard," "hard," "very hard," and "extremely hard," and in order to give an idea of these different categories the following examples among well-known trees may be instanced:—

Extremely soft	*Cochlospermum Gossypium.*
Very soft	*Bombax malabaricum.*
Soft	*Cedrela Toona.*
Moderately hard	*Tectona grandis.*

Hard	*Shorea robusta.*
Very hard	*Dalbergia Sissoo.*
Extremely hard	*Hardwickia binata.*

The *grain* is usually recorded as being "close," "even," "open," "rough," "cross," etc., etc., and the relative roughness or smoothness is generally given.

Annual rings are referred to as regards their presence or absence, their being more or less well marked, and the marks which so distinguish them.

As in the case of the hardness, so, too, the *pores* are described according to a scale of size which varies in those trees which possess them, as "extremely small," "very small," "small," "moderate-sized," "large," "very large," and "extremely large." As examples of these categories may be given—

Extremely small	*Buxus sempervirens.*
Very small	*Acer cultratum.*
Small	*Adina cordifolia.*
Moderate-sized	*Bassia latifolia.*
Large	*Albizzia Lebbek.*
Very large	*Erythrina suberosa.*
Extremely large	Many climbers.

The classification of the *medullary rays* has been made upon a similar plan, and they have been divided into "extremely fine," "very fine," "fine," "moderately broad," "broad," "very broad," and "extremely broad," examples of which categories are—

Extremely fine	*Euonymus lacerus.*
Very fine	*Diospyros tomentosa.*
Fine	*Albizzia Lebbek.*
Moderately broad	*Dillenia pentagyna.*
Broad	*Platanus orientalis.*
Very broad	*Quercus dilatata.*
Extremely broad	*Quercus incana.*

In addition, the distance between the medullary rays is usually given and is sometimes compared with the diameter of the pores. And, as far as possible, the length and depth of the rays have been noted, as well as those cases in which the broad rays are obviously made up of several fine ones. The character of the "silver-grain" given by the radial section of the medullary rays is also usually recorded.

Other noticeable characters are the presence or absence of concentric lines or belts; and of patches of looser tissue than that of the general structure and the way such patches are disposed. These other characters are often valuable accessories in determining the genus, and even the natural Order to which a wood belongs. The woods of all species of ANONACEÆ are characterized by regular ladder-like concentric bars on a transverse section; and though similar bars may be also seen in other Orders, they are rarely so regular, and the character affords an almost unmistakable sign for recognizing the trees of that Order.

In SAPOTACEÆ, again, the wavy concentric lines and the arrangement of the pores in short echeloned lines afford a character which

is almost certain; and if any doubt could arise it would be between that Order and its neighbour the EBENACEÆ, which, however, almost always differs in having the wood of a white, grey, or black colour, while that of SAPOTACEÆ is generally of some shade of red or yellow.

Concentric lines of soft texture occur in many Orders and genera. They are very common in the LEGUMINOSÆ, as may be seen from the description of the groups which the woods of that family form. They occur also in *Garcinia* and *Mesua* among GUTTIFERÆ; in *Elæodendron*, *Celastrus*, and *Lophopetalum* among CELASTRINEÆ; in *Heynea*, *Amoora*, and *Walsura* among MELIACEÆ; *Cordia* in BORAGINEÆ; in *Ficus*, and in other genera. The wood of the trees of the great and important order of CONIFERÆ is always recognizable, at any rate, by the constant character of the absence of pores; that of the chief CUPULIFERÆ by the arrangement of the pores in wavy, radial lines, and a particular texture. Somewhat broad medullary rays indicate the orders DILLENIACEÆ, RHIZOPHOREÆ, and MYRSINEÆ; as does a close and even-grained wood, most species of the great Order of RUBIACEÆ; while the large genus *Ficus* has its woods extremely uniform in character and recognizable by alternate layers of soft and firm tissue. In this way a little practice may enable a near guess to be made at the scientific name of the tree yielding a wood under investigation.

Mention has been made of some Orders and genera which have woods of similar character and structure, but it is necessary to point out that there is no regular rule for determining Orders and genera by means of the wood; for in some cases the structure of the woods of different species in a genus differs greatly in character. In the genus *Dalbergia*, for instance, there is a very great dissimilarity, so that while some species have hard dark-coloured heavy woods, others have white, often soft, woods without heartwood; and one species has the peculiarity of a wood divided into concentric rings, which are often separable, of alternate layers of wood and bast-like tissue. But, in general, it may be said that in species of the same genus the wood structure is fairly constant, and may often serve as a valuable aid in the determination of recent plants, as it has of fossil ones.

It is not always easy to give the reasons which lead one who is tolerably conversant with the structure of woods to suggest their botanical affinities; there are often characters of appearance, touch, colour, odour, etc., which afford clues, as well as the arrangement and relative size of the pores and medullary rays, and the presence or absence of annual rings; so experience and habit of observation have to be added to an acquaintance with structure in order to recognize, at first sight, the genus or Order of plants to which a wood is referable. Still, it is hoped that the descriptions, aided by a few selected photographs of sections magnified 3½ diameters, may be of assistance. These sections are copies of those in Dr. Nordlinger's "Holzquerschnitte," most of which were made from wood-specimens supplied to him by Sir D. Brandis soon after 1878. The photographs were made in the Botanical Laboratory at the Royal Indian Civil Engineering College, Cooper's Hill, with the permission of the Principal

Professor of Forestry, by his assistant, Mr. Arthur Deane, to whom my thanks are due.

It has been suggested to me that a key to the principal woods, based upon structure, would be a useful addition to this work, and I have long considered whether such a key were feasible, and if so, how best it could be prepared. For an example of such a key there is that given in the handbook which accompanies Nordlinger's Wood Sections, and which is practically the same as that prepared by Dr. R. Hartig of Munich.* In that key, the following arrangement has been adopted :—

1. Monocotyledons.
2. Tree ferns.
3. Cycadeæ.
4. Coniferæ.
    - A. Without resin-ducts.
        - (1) Annual rings distinct.
        - (2) „ „ indistinct.
    - B. Possessing resin-ducts.
5. Dicotyledons.
    - A. Annual rings not well marked.
    - B. Annual rings clearly marked, but without special belt of pores.
    - C. Annual rings clearly marked by a belt of pores in spring-wood.

In A, B, and C the subdivisions are according to the arrangement of the pores.

In Mathieu's "Flore Forestière" (4th edition, revised by Mons. P. Fliche) the following is the arrangement adopted :—

Broad-leaved species (Dicotyledons)—	Examples.
A_1. Pores in groups.	
B_1. Pores clearly unequal.	
C_1. Pores in radial, oblique and branching lines	Oak, chestnut.
C_2. Pores in concentric lines . .	Elm, *Celtis*.
C_3. „ short concentric arcs .	Ash, mulberry.
C_4. „ oblique anastomozing lines forming a network . .	Laburnum.
B_2. Pores equal.	
C_5. Pores in oblique or concentric lines, medullary rays broad . .	Furze.
C_6. Pores in radial lines, medullary rays narrow	Buckthorn.
A_2. Pores scattered.	
B_3. Pores clearly unequal.	
C_7. Medullary rays broad . . .	Barberry, tamarisk.
C_8. „ „ narrow . .	Sea buckthorn.
B_4. Pores equal.	
C_9. Medullary rays broad . . .	Plane, beech, alder.
C_{10}. „ „ moderate-sized, narrow or very narrow.	

* "Die Unterscheidungsmerkmale der Wichtigeren in Deutschland Wachsenden Hölzer." Munich. 1888.

D_1. Wood hard.	
E_1. Wood grey to brown . .	Walnut, laurel.
E_2. Wood red to reddish-brown .	Cherry, plum, apple.
E_3. Wood yellow or tawny .	Olive, box, elder.
D_2. Wood usually white, soft .	Lime, poplar.
Resin-woods (conifers).	
A_3. No resin-ducts.	
B_5. Annual rings irregular in breadth .	Yew, juniper.
B_6 " " regular . . .	Cedar, silver fir.
A_4. With resin-ducts.	
B_7. Wood white, heartwood scarcely distinguishable	Spruce.
B_8. Wood reddish.	
C_{11}. Sapwood narrow . . .	Larch.
C_{12}. " broad	Pine.

In Prof. Marshall-Ward's work, "Timber and Some of its Diseases," the following, put briefly, is the classification proposed :—

1. *Conifers.*	
A_1. No resin-canals.	
B_1. No true heartwood . . .	Silver fir.
B_2. A distinct heartwood . . .	Yew, juniper, cedar.
A_2. Resin-canals present.	
B_3. No true heartwood . . .	Spruce.
B_4. Heartwood distinct . . .	Pine, larch.

2. *Dicotyledons.*
A_3. Annual rings not distinguishable, but "partial zones" forming incomplete bands sometimes present.
B_5. Partial zones present, forming "false rings."
C_1. Medullary rays of two kinds.
C_2. " " all of one kind and narrow.
B_6. Partial zones absent.
C_3. Soft wood, no heartwood.
C_4. Harder wood; heartwood present.
A_4. Annual rings always distinguishable.
B_7. Annual rings clear, through conspicuousness of spring-wood pores.
C_5. Annual rings marked by larger spring-wood pores.
D_1. Some medullary rays broad.
D_2. All medullary rays alike and fine.
C_6. Annual rings marked by more numerous and crowded spring-wood pores, not larger in size.
B_8. Annual rings clear, from the closer texture of the autumn wood, not from any special conspicuousness of the pores.
C_7. Pores easily visible.
C_8. " minute, only visible with a lens.
D_3. Wood hard.
D_4. Wood soft.

I have thought it useful to give these different methods of classification in order that Forest officers who may desire to do it may utilize them in preparing local keys to the woods of their locality. After

much consideration, I came to the conclusion that it would be useless to attempt to make a general key, not only because it would be an exceedingly difficult thing to do for so many species, but because when made it would be of little or no practical utility. A key, to be of use in any given locality, should not be complicated with references to numbers of kinds not found or likely to be found there, but should be short and refer only to those species of importance which are likely to be met with. Consequently, in my opinion, local keys would be much more useful than a general one, and need only take in a few kinds of wood. As an example, a key for the chief woods which are collected at the Hardwar drift-timber depôt would include a few conifers such as Deodar, cypress, two pines, spruce and silver fir; such other trees as Sál, Sissu, Toon, two or three *Terminalias*, *Bombax*, some of the softer hill woods like elm, birch, alder, poplar likely to be floated, and so on. The list would not be difficult to make, nor would the key to the woods.

And here it is well to explain that the descriptions given in this work notice only characters which are readily capable of being observed with no greater enlargement than that given by an ordinary pocket lens, magnifying from 5 to 20 times, so that a Forest officer wishing to determine the species to which the woods in a drift depôt, or the pieces which make up a stack of fuel, belong, may have the means of doing so, without having to take the trouble of cutting thin sections such as would be necessary if a compound microscope had to be employed. In some of the Indian Railway fuel contracts with the Forest Department, it is stipulated that certain woods are not to be used, and it therefore becomes necessary from time to time, before taking over stacks from a contractor, to make sure that the prohibited woods are not included. A knowledge of the character of the structure and other peculiarities of such woods is then necessary, and if at the same time the better-class fuel woods are also known, the inspecting officer can himself do the work speedily and thoroughly, and be free from the obvious danger of having to rely on the diagnosis of a subordinate or workman. Again, it has sometimes happened on Indian railways that attempts have been made by contractors to palm off sleepers of inferior woods as belonging to better-class kinds; and here again structural knowledge is important. Cases of this are by no means uncommon, and I have myself known Chir pine to be palmed off as Deodar and Eng or Kanyin as Pyingado. When it is understood that Chir pine wood is readily recognizable from Deodar wood by its possessing resin-ducts, of which the latter has none, its identity can be at once detected, even though it may have been scented with deodar oil and otherwise "doctored." So, too, the open structure of Eng wood with scattered pores surrounded by loose tissue at once enables it to be distinguished from that of Pyingado, which has its pores smaller, grouped, and filled with resin. Teak is almost always at once recognizable by its oily nature, its scent, and especially by its well-marked annual rings, and a very little practice indeed makes it possible to recognize it with certainty.

After all, written descriptions alone, though useful, are not sufficient for really accurate determination of woods; any more than they

that constitute the forest vegetation. The following Table gives an estimate which I think approximates to the statistics of such species, so far as we know at present:—

Name of series.	No. of Natural Orders.	No. of genera.	No. of species.			
			Trees.	Shrubs.	Climbers.	Total.
Thalamifloræ	21	153	462	139	136	737
Discifloræ	19	157	394	126	120	640
Calycifloræ . . .	17	196	525	215	189	929
Gamopetalæ . . .	26	228	408	606	243	1257
Apetalæ	23	152	628	234	48	910
Total Dicotyledons .	106	886	2417	1320	736	4473
Gymnosperms .	3	15	21	11	5	37
Monocotyledons	5	45	69	89	66	224
Total Phanerogams .	114	946	2507	1420	807	4734
Cryptogams .	1	4	6	9	—	15
Grand total . .	115	950	2513	1429	807	4749

Introduced trees and shrubs and a certain number of shrubs and climbers of woody character which have not been counted would probably raise the grand total to about 5000, which may then be assumed to be the limiting number of species in the woody vegetation of India. The magnitude of this great assemblage of plants is perhaps better realized when it is considered that in the "Forest Flora of France," by MM. Mathieu and Fliche, 54 Natural Orders, containing 143 genera with 397 species, are described, the species including every plant in the least woody (*e.g.* the Rock roses, the Cranberry, and the Thyme) as well as many introduced kinds. In the British Isles, taking the descriptions in Hooker's "Student's Flora" on the same basis as is done in the French statistics, and including, as they do, a few common and well-naturalized exotics, there are 33 Natural Orders, containing 67 genera with 134 species. Sir Joseph Hooker, who has most kindly looked over the proofs, not only of the Introduction but of much of the letterpress of the book, and given me valuable criticisms and helped me to avoid many mistakes, tells me that the number of 5000 woody plants covers about one-third of the Indian Flora. The proportion is very large, and is probably unequalled for any other country of the globe except, perhaps, Australia.

The number of species of which the wood has been described in these pages comes to about 1450, including exotics. Among the woods described are representatives of most of the important genera, and there are very few of the really important timber-woods of which no specimen has been available.

In conclusion, I desire to express my best thanks to those officers of the Indian Forest Department, whether of the Imperial or Provincial Staff, and to many in other branches of Government service, for their help in supplying specimens, information or criticism. I hope I

have not omitted to give in the pages of the book the names of those to whom I am indebted for help. I have also to thank the Director and staff of the Royal Gardens, Kew, for their assistance, and for permission to examine and describe many of the specimens preserved in their splendid museum. And I must not omit, finally, to thank the Government of India for their appreciation of the utility of the first edition, and for the assistance they have given me in publishing its successor.

J. S. GAMBLE.

LISS,
Oct. 1, 1902.

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A MANUAL OF INDIAN TIMBERS

Division I. PHANEROGAMÆ.

Phanerogamic plants are divided into three classes, I. Dicotyledons, II. Gymnosperms and III. Monocotyledons, adopting the order of arrangement given in Bentham and Hooker's "Genera Plantarum," and followed in the "Flora of British India" and other works quoted herein.

In regard to wood structure, speaking generally, and referring only to easily seen characters, these three classes are recognized :

Class I. Dicotyledons. By distinct bark and wood; general presence of annual rings, or at any rate of rings of new growth added on each year at the outside of the wood cylinder and the inside of the bark ring; presence of vessels or pores and medullary rays of varying size in the fibro-vascular tissue; and usually a distinct sapwood and heartwood.

Class II. Gymnosperms. By the same, except that vessels or pores are usually completely wanting, and that resin ducts are often present either vertical in the tissue or horizontal in the medullary rays.

Class III. Monocotyledons. By the general absence of distinct bark and of annual additional growth on the outside of the wood cylinder; absence of annual *rings; presence of separate fibro-vascular bundles irregularly arranged and containing* vessels or pores, but not medullary rays.

There are, of course, some slight exceptions, as, for instance: the woods of certain Dicotyledons, like *Pisonia* in Nyctagineæ and *Ægialitis* in Plumbagineæ, show more or less the structure of Monocotyledons; Gnetaceæ in Gymnosperms possess pores like those of the Dicotyledons; while, in Monocotyledons, the woody Liliaceæ and members of some allied Orders do, more or less, increase in diameter and form new separate fibro-vascular bundles. But such exceptions are few and unimportant.

Class I. DICOTYLEDONS.

This Class is subdivided into Ser[redacted]llows :—

Series	I. Thalamifloræ	Orders	1 to 21
„	II. Discifloræ	„	22 to 40
„	III. Calycifloræ	„	41 to 57
„	IV. Gamopetalæ	„	58 to 83
„	V. Apetalæ	„	84 to 106

As already mentioned, the wood of Dicotyledons is characterized by distinct bark and wood, the general presence of annual rings, the presence of pores and medullary rays, and the usual presence of distinct heartwood and sapwood. A transverse section shows: (1) a central *pith;* (2) a series of layers of fibro-vascular tissue in which the

most prominent features are: (*a*) *annual rings* which are usually present only in woods grown in a climate where there are distinct seasons, (*b*) *pores* of greater or less magnitude and various arrangements, usually larger and more prominent in the inner parts of the annual rings, and gradually getting smaller and less prominent towards the outer parts, (*c*) *medullary rays* represented on a cross or transverse section as radial lines of greater or less breadth, on a radial section as vertical and radial plates, and on a tangential section as lenticular patches of greater or less breadth and depth, (*d*) other characters such as occasional patches called "medullary patches," or large cells, or pores filled with resin or mineral matter, the whole set in (*e*) tissue, mostly consisting of wood fibres, chiefly tracheides without the "bordered pits" seen in Coniferous wood, and varying in the size of the cavities or "lumina" and the thickness of the walls, and so showing harder or softer structure and a difference of colour; and then (3) a *bark* ring, the inner part of fibrous layers, the outer of hard dead or nearly dead tissue.

SERIES I. THALAMIFLORÆ.

ORDER I. RANUNCULACEÆ.

Shrubs, erect or climbing, and herbaceous plants, of little importance in the forests. The roots of species of *Aconitum* yielding an important but poisonous drug are collected in the Himalaya for export. *Pæonia Emodi*, Wall.; Fl. Br. Ind. i. 30; Vern. *Mamekh*, Pb., is an erect perennial herb of the Western Himalaya, whose tubers are used medicinally and whose young shoots are sometimes eaten as a vegetable in Kumaon. Of woody plants there are two genera, Clematis and Naravelia, with 22 species in all.

1. CLEMATIS, Linn.

Twenty species are described in Fl. Br. Ind. i. pp. 2 to 6, and Kurz adds two more for Burma. The commonest kinds in the Western Himalaya are *C. grata*, Wall., *C. nutans*, Royle, and *C. orientalis*, Linn., with white or yellowish-white panicles of flowers; *C. montana*, Ham., with large white star-shaped flowers, which festoons the fir and deodar trees in the upper forests, and *C. barbellata*, Edgw., with dull purple ones, common among bushes in the hill forests; while *C. Buchananiana*, DC, is conspicuous for its woolly leaves and large soft tomentose bell-shaped flowers. In the Eastern Himalaya this latter species is the most common, with *C. grewiæflora*, DC, covered all over with golden pubescence, and the pink-flowered *C. smilacifolia*, Wall. In the sub-Himalayan forests *C. Gouriana*, Roxb., which resembles the European Clematis, is very common; and *C. Wightiana*, Wall., is conspicuous in the hills of Western and Southern India. *C. triloba*, Heyne, is common in the Deccan. These climbers are all very ornamental, but they have little or no value, though Kurz says that the "stems of Burmese species while fresh are often used for ropes and are very strong." Mathieu, Fl. For. p. 9, gives the weight of the wood at 24 to 36 lbs. per cubic foot for *C. Vitalba*, Linn., the European Clematis or Traveller's Joy.

Woody climbers. *Bark* grey, fibrous, peeling off in long strips. *Wood* white or yellowish-white, soft, porous. *Pores* arranged in rounded groups between the broad or very broad *medullary rays*, the groups having alternately very large pores and small ones, so that a section (see Nordlinger, Vol. 2, *C. Vitalba*) has the appearance of lacework. There is a big central *pith*, and the outer edge of the small-pored groups defines the *annual ring*.

H 2851.	Mahasu, Simla, 8000 ft.	*C. montana*, Ham. Vern. *Kanguli*, *ghantidli*, Hind.; *Kauniabâli*. Jaunsar.
H 4792.	Deoban, Jaunsar, 8500 ft. (32 lbs.)	

H 2852. Mahasu, Simla, 8000 ft. } *C. barbellata*, Edgw. Vern. *Kauni*,
H 3156. Theog, „ 7000 ft. (40 lbs.) } Jaunsar.
H 2820. Simla, 6000 ft. . . . . *C. grata*, Wall.
H 2838. Simla, 6000 ft. . . . . *C. Buchananiana*, DC.

all collected by myself.

2. NARAVELIA, DC. Two species: *N. zeylanica*, DC; Fl. Br. Ind. i. 7 (*Atragene zeylanica*, Roxb. Fl. Ind. ii. 670); Vern. *Sargoyit*, Burm., is common in the tropical forests throughout most of India; and *N. laurifolia*, Wall. occurs in Burma.

ORDER II. DILLENIACEÆ.

A tropical Order of plants, usually with showy flowers. There are five genera, trees or shrubs, some climbing. They belong to two Tribes, viz.—

Tribe I. Delimeæ . . . . Delima, Tetracera.
„ II. Dillenieæ . . . . Schumacheria, Wormia, Dillenia.

1. DELIMA, Linn.

1. D. sarmentosa, Linn.; Fl. Br. Ind. i. 31; Kurz For. Fl. i. 22; Gamble Darj. List 1; Trimen Fl. Ceyl. i. 5. *Tetracera sarmentosa*, Willd.; Roxb. Fl. Ind. ii. 645. Vern. *Monkyourik*, Lepcha; *Korasa-wel*, Cingh.

A woody climber. *Bark* red, peeling off in hard flakes. *Wood* light brown, moderately hard, with large round *pores* and broad *medullary rays*.

Northern and Eastern Bengal, Burma and the Andamans, in moist forests; low country of Ceylon.

The leaves are hard and are sometimes used to polish wood, etc. The stems are used in Ceylon for cattle-ropes.

E 3370. Kasalong Forests, Chittagong (Gamble).

2. TETRACERA, Linn.

Two species. *T. lævis*, Vahl; Fl. Br. Ind. i. 31; Trimen Fl. Ceyl. i. 6 (*T. trigyna*, Roxb. Fl. Ind. ii. 645); Vern. *Et-korasa-wel*, Cingh., is a climbing shrub of the forests of Malabar extending to Ceylon; and *T. Assa*, DC; Fl. Br. Ind. i. 31; Kurz For. Fl. i. 22, a climber of the forests of Chittagong. Both have scabrid leaves and small white panicled flowers. The wood of *T. macrophylla*, Wall. of the Straits Settlements has the following characters:—

Bark brick-red, peeling off in papery flakes. *Wood* red, soft. *Pores* scanty, moderate-sized to large. *Medullary rays* broad, not numerous.

Penang—Kew Museum (H. N. Ridley).

3. SCHUMACHERIA, Vahl. Three erect or scrambling shrubs, endemic in Ceylon. *S. castaneæfolia*, Vahl; Fl. Br. Ind. i. 35; Trimen Fl. Ceyl. i. 10; Vern. *Kekiri-wara*, Cingh., is common in the moist low country.

4. WORMIA, Rottb.

1. W. triquetra, Rottb.; Fl. Br. Ind. i. 35; Trimen Fl. Ceyl. i. 11, t. 3. Vern. *Diya-para*, Cingh.

A moderate-sized tree. *Wood* red, close-grained, moderately hard.

Pores moderate-sized, scanty. *Medullary rays* fine to moderately broad, silver-grain not prominent.

Moist low region of Ceylon, up to 2000 ft., endemic.

The wood is used in building; it weighs 44 lbs. per cubic foot. The nut gives an oil.

Ceylon Collection, No. 22, old (Mendis) . . . . lbs. 44

Ceylon: Int. Exhn., 1862—Kew Museum.

5. DILLENIA, Linn.

Ten species, handsome trees with large or very large leaves. They are in two Subgenera, viz.—

1. EUDILLENIA, with persistent leaves and white flowers, *D. indica*, *D. bracteata*, and *D. retusa*.

2. COLBERTIA, with deciduous leaves and yellow flowers, *D. aurea*, *D. pilosa*, *D. pulcherrima*, *D. scabrella*, *D. parviflora*, *D. pentagyna*, and *D. floribunda*, Hook. f. and Th.

The last named is a very little-known species of Martaban. *D. bracteata*, Wight; Fl. Br. Ind. i. 37 (*Wormia bracteata*, Bedd. Fl. Sylv. t. 115), is a large tree of the hills of the South Deccan. *D. pilosa*, Kurz For. Fl. i. 20, is a tree of the upper mixed forests of the Andamans. Kurz says it has a greyish, close-grained, coarsely-fibrous, heavy wood. In the Fl. Br. Ind. it is placed under *D. pentagyna*, and though Kurz identifies his Andaman plant with Roxburgh's (Fl. Ind. ii. 652), the latter got his specimens from E. Bengal or Assam.

Wood light red or reddish-brown, moderately hard. *Pores* moderate-sized, uniformly distributed, often filled with a white substance. *Medullary rays* of two classes, numerous broad or moderately broad with a few very fine between them. A good silver-grain.

1. D. indica, Linn.; Fl. Br. Ind. i. 36; Brandis For. Fl. 1; Kurz For. Fl. i. 19; Gamble Darj. List 1; Talbot Bomb. List 2; Trimen Fl. Ceyl. i. 12. *D. speciosa*, Thunb.; Roxb. Fl. Ind. ii. 650; Bedd. Fl. Sylv. t. 103. Vern. *Chalta*, Hind.; *Chalta, hargesa*, Beng.; *Otengah*, Ass.; *Rai, oao*, Uriya; *Ramphal, mechiaphal*, Nep.; *Phamsikol, sun-góm*, Lepcha; *Panpui*, Garo; *Uva, peddu kalinga*, Tel.; *Uva*, Tam.; *Betta-kanagala, kad-kanagala*, Kan.; *Syalita*, Mal.; *Mota karmal*, Mar.; *Thapru, chauralesi*, Magh; *Thabyu*, Burm.; *Carllow*, Taleing; *Hondapara, wampara*, Cingh.

A large evergreen tree. *Bark* red, moderately thick, smooth, peeling off in small hard flakes. *Wood* red with white specks, close-grained, moderately hard. *Annual rings* faint, distinguished by the scarcity of pores in the autumn wood. *Pores* moderate-sized, fairly numerous, evenly distributed. *Medullary rays* of two classes, broad and very fine, the latter bent round the pores and usually 2 to 4 between each pair of broad rays; silver-grain good.

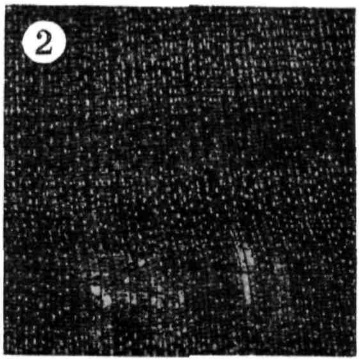
Damp evergreen forests at the base of the Himalaya from Nepal eastwards; Assam, Eastern Bengal, and Burma; valleys of the Circar Hills, the Konkan, Kanara, and Malabar; low country of Ceylon: often cultivated in gardens.

A conspicuous tree in its localities, at once recognizable by the colour of the bark, the large serrate leaves, large white flowers, and huge succulent fruit, which is more or less edible. The leaves are occasionally used to polish ivory, and are, according to Mr. Brownlow of Cachar, used to feed the "Eri" silkworm (*Attacus Atlas*, Linn.).

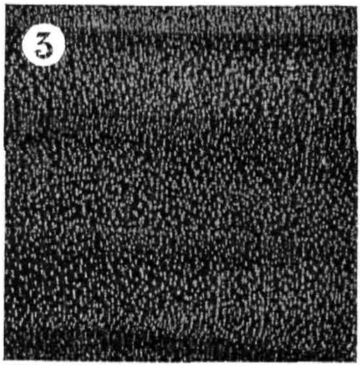
The wood is not much used, it is however made into gunstocks and helves, and in some places in the construction of houses and ships (Brandis). If used wholly under water, it turns jet black and lasts many years (S. E. Peal). It gives good charcoal.

I.

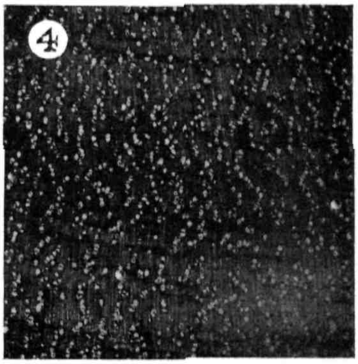
DILLENIA INDICA.



SACCOPETALUM LONGIFLORUM.

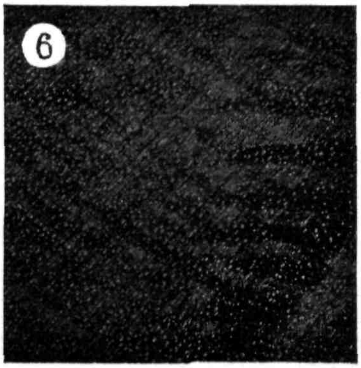


FLACOURTIA CATAPHRACTA.



CALOPHYLLUM INOPHYLLUM.

SCHIMA WALLICHII.



ELÆOCARPUS LANCEÆFOLIUS.

(Magnified 3½ times.)

Its weight per cubic foot is given as 41 to 45 lbs. (Brandis), 44 lbs. when seasoned and 55 to 60 lbs. when unseasoned (Beddome), 41 lbs. (Kurz), 44·5 lbs. (Smythies in 1878), and the following are the results of experiments recorded:—

	Wt. in lbs.	P.
Skinner, No. 58, in 1862, in S. India	45	721
Kyd, in 1831, with Assam wood, bars 2′ × 1″ × 1″ .	45	243 (doubtful)

The growth is moderate; countings made in 1878 gave 7 rings per inch, and a round (No. E 2310) in the Bengal Forest Museum gave 62 rings for a mean radius of 6½ in. or nearly 9 rings per inch.

		Wt. in lbs.
E 596.	Khookloong Forest, Darjeeling Terai (Manson) . . .	40
E 2310.	Sivoke Forest, do. (Gamble)	41
E 1395.	Chittagong (Chester)	48
B 2501.	Burma (Brandis, 1862)	49
W 4190.	Cochin (Kohlhoff)	46
No. 51.	Ceylon collection, new (Mendis)	41

Nordlinger's Sections, vol. 11 and vol. 9 (*D. speciosa*) (Tab. I. 1).

2. **D. retusa,** Thunb.; Fl. Br. Ind. i. 37; Bedd. Fl. Sylv. vi.; Trimen Fl. Ceyl. i. 13. Vern. *Godapara*, Cingh.

A moderate-sized tree. *Bark* brownish-grey. *Wood* reddish-brown, moderately hard, resembling that of *D. indica*, but more compact. *Annual rings* not distinct. *Pores* moderate-sized, rather scanty, evenly distributed. *Medullary rays* of two classes, broad and very fine, the broad ones distinct and regular: silver-grain handsome.

Moist low country of Ceylon, up to 2000 ft.
A rather common Ceylon tree. The wood is used in building.

	lbs.
Ceylon Collection, No. 29 (old), 39 (new) (Mendis)	51

Ceylon: Int. Exhn., 1862—Kew Museum.

3. **D. aurea,** Smith; Fl. Br. Ind. i. 37; Brandis For. Fl. 2; Kurz For. Fl. i. 20. Vern. *Chamaggai*, Oudh; *Dheugr*, Nep.; *Byu*, Burm.

A deciduous tree, small in N. India, large in Burma. *Bark* ½ in. thick, reddish-grey, soft, corky, exfoliating in irregular scales. *Wood* light reddish-brown, moderately hard. *Annual rings* rather indistinct. *Pores* small, scanty. *Medullary rays* of two classes, the moderately broad to broad ones separated by a few very fine ones: silver-grain good.

Forests of Oudh and Gorakhpur; drier hill forests of Burma, at 2–3000 ft.; Andaman Islands.

The wood is not used: Benson gives W = 44 lbs., P = 834; Brandis gives W = 45 lbs.; specimens examined a little more.

		lbs.
O 4829.	Gorakhpur (H. G. Billson)	45
B 2502.	Burma (Brandis, 1862)	49
B 2253.	Andaman Islands (Col. Ford, 1866)	48

Nordlinger's Sections, vol. 5.

4. **D. pulcherrima,** Kurz; Fl. Br. Ind. i. 37; Kurz For. Fl. i. 19. Vern. *Byu*, Burm.

A deciduous tree. *Bark* ½ in. thick, light brown or whitish-grey, corky, peeling off in small papery flakes. *Wood* dark reddish-brown, moderately hard. *Annual rings* marked distinctly by the scarcity of pores in the autumn wood. *Pores* small to moderate-sized rather

scanty. *Medullary rays* of two classes, broad and very fine: a good silver-grain.

Eng forests and savannahs in low country of Burma, extending north to Myitkyina.

Kurz says the wood is hard and strong, and gives W = 69 lbs., but the specimens examined gave only 45 lbs.

	lbs.
B 5063, 5017, 5050. Pegu forests	45

5. **D. scabrella**, Roxb. Fl. Ind. ii. 653; Fl. Br. Ind. i. 38; Kurz For. Fl. i. 21. Vern. *Akáchi*, Garo.

A deciduous tree. *Bark* grey, smooth, with horizontal short fissures. *Wood* light reddish-brown, moderately hard. *Annual rings* indistinct, marked by a darker autumn belt without pores. *Pores* moderate-sized, rather scanty. *Medullary rays* of two classes, broad and very fine: a good silver-grain.

Assam, the Khasia hills up to 3000 ft., Sylhet, and Chittagong.

	lbs.
E 4864. Goalpara, Assam (Perrée)	40
R. Bot. Garden, Calcutta—cyclone 1864 (Kew Museum).	

6. **D. parviflora**, Griff.; Fl. Br. Ind. i. 38; Kurz For. Fl. i. 21. Vern. *Lingyaw*, Burm.

A deciduous tree. *Bark* greyish-brown, rough (smooth when young). *Wood* reddish-brown, moderately hard. *Annual rings* indistinct. *Pores* small to moderate-sized, rather scanty. *Medullary rays* of two classes, moderately broad and very fine: a good silver-grain.

Mixed forests of Burma, especially upper ones, up to 2000 ft.; Andaman Islands.

Three specimens have been received from Burma, which differ slightly in bark and structure. I think B 5018 from Prome is really *D. indica*, and that the others only belong to this species.

	lbs.
B 4876, 5034. Pegu	47

7. **D. pentagyna**, Roxb. Fl. Ind. ii. 652; Fl. Br. Ind. i. 38; Bedd. Fl. Sylv. t. 104; Brandis For. Fl. 2; Kurz For. Fl. i. 21; Gamble Darj. List 2; Talbot Bomb. List 2. *D. augusta* and *D. pilosa*, Roxb. Fl. Ind. ii. 652. Vern. *Aggai*, Oudh; *Kallai*, C.P.; *Karkotta*, Beng.; *Akshi*, Ass., Mechi; *Tatri*, Nep.; *Pashkouli*, Rajbanshi; *Ayar*, Monghyr; *Akáchi*, *achki*, Gáro; *Korkot*, Sonthal, Oraon; *Korkotta*, Kól; *Shukni*, Lepcha; *Rai*, Uriya; *Kanagalu*, *karmal*, *karumbel*, *karweil*, Mar.; *Mirchi*, Baigas; *Kallei*, Gondi; *Malé geru*, Coorg; *Kanagola*, *kaltéga*, *kad-kanagala*, *machil*, Kan.; *Rai*, *pinnai*, *nai-ték*, Tam.; *Rawadan*, *chinna-kalinga*, Tel.; *Zambrún*, Magh; *Panna*, *kodapanna*, Mal.; *Pattipanna*, Trav. Hills; *Zinbyún*, Burm.

A deciduous tree. *Bark* ½ in. thick, grey or pale-brown, smooth, inner substance red. *Wood* rough, moderately hard, reddish-grey; apt to split, warp, and crack; durable. *Annual rings* marked by a narrow belt in the outer edge (autumn wood) without pores. *Pores* small and moderate-sized, many of them filled with a white substance, which is visible both on the horizontal and vertical sections, and is one of the characteristics of the wood. *Medullary rays* of two classes, the larger moderately broad, with a few intermediate very fine rays: silver-grain good.

Sub-Himalayan forests from Oudh eastwards; Eastern Bengal and Burma; Orissa, the Circars, Deccan and Carnatic; scarce in the C.P., and then only on low ground; Gujarat and the Mahratta country; Ghâts and Western Coast.

This species is a conspicuous tree, and usually affects dry forests and open grass lands, as well as the more open Sál forests in Northern India.

Except the teak, perhaps, it has the largest leaves of any of our forest trees, for they often reach 2 ft. long. The flowers, which appear in the hot season, are yellow, in fascicles or tuberosities on the branches, and the fruit is small and fleshy. The flower-buds and fruit are eaten, and have a pleasant acid flavour. The leaves are sometimes used for plates, and at Poona as a substratum for thatched roofs (Dalz. and Gibs.).

The wood is but little used, occasionally only in construction, shipbuilding, and for rice-mills (Brandis), and houseposts (Kurz); it is durable, but very liable to warp and split, and has much the character of beech; it makes good charcoal. Its weight per cubic foot is given as 45 to 48 lbs. (Brandis), 48 lbs. (Kurz), while the average of the specimens examined gives 47·5 lbs. Beddome gives 70 lbs. for seasoned and 85 to 90 lbs. for unseasoned wood: in this he probably follows Skinner, who may have made some mistake. The following experiments are recorded:—

	Wt. in lbs.	P.
Skinner, in S. India, in 1862, No. 57	70	907
Benson, in Burma, with bars 3′ × 1·4″ × 1·4″	58	960
Kyd, with Assam wood, in 1831, bars 2′ × 1″ × 1″ . . .	45	593
Brandis, with Burma wood, in 1864, bars 3′ × 1″ × 1″ . .	45	740
Bourdillon, Travancore, in 1896, bars 2′ × 1″ × 1″ . . .	44	554

48 lbs. may probably be adopted as a fair average for the weight.

The rate of growth is moderately fast, our specimens giving 5 to 6 rings per inch of radius. Saplings grow very fast with straight, white, fleshy-barked stems, crowned by very large leaves, the fleshy stems helping them to resist jungle fires. The leaves are used for thatching huts.

		Wt. in lbs.
O	348. Gorakhpúr, N.-W.P. (1868)	54
E	658. Rakti Forest, Darjeeling Terai (Manson)	45
E	2311. Sivoke Forests, „ (Gamble)	54
B	302, 303. Burma (1867)	47
B	557. Prome, Burma (Ribbentrop)	38
C	3571. Khurdha Forests, Orissa (Gamble)	49
C	4211, 4215. Ganjam Forests, Orissa (Gamble)	46

B 2245 (52 lbs.) and B 2275 (44 lbs.), sent by Col. Ford from the Andaman Islands in 1866 under the name *Lingyau*, have a structure more like that of *D. aurea*. They may belong to *D. pilosa*, Kurz.

ORDER III. MAGNOLIACEÆ.

An Order of great interest, though containing only a few Indian species and those chiefly found in the more or less inaccessible forests of the North-East Himalaya and Assam. The flowers are usually large and handsome, often sweet-scented, and some of the species are among the most beautiful of trees.

Since the publication of the "Flora of British India," vol. i., this Order has been the subject of a Monograph by Sir G. King, K.C.I.E., F.R.S., published in vol. iii. of the "Annals of the Royal Botanic Garden of Calcutta." The Monograph has to some extent revised the work of the "Flora of British India," and added a few Indian species. There are four Tribes with eight Genera, viz.—

Tribe I. Trochodendreæ . . .	Euptelea.
„ II. Wintereæ	Illicium.
„ III. Magnolieæ	Talauma, Magnolia, Manglietia, Michelia.
„ IV. Schizandreæ	Schizandra, Kadsura.

The two latter Genera contain only climbers. Some of the American Magnolias are sometimes seen in cultivation in India. The Tulip tree, *Liriodendron tulipiferum*, Linn. which has a useful carpentry wood, and is found in the United States of America, would be worth introduction into gardens in the Indian hill stations.

Wood usually soft, even-grained, white, grey, yellow or olive-brown.

Annual rings distinct. *Pores* small, fairly regular. *Medullary rays* fine, numerous, regular. In *Magnolia* the wood is sometimes in alternate layers of light and dark tissue, in *Schizandra* or *Kadsura* it has the porous structure of climbers.

1. EUPTELEA, Sieb. and Zucc. *E. pleiosperma*, Hook. f. and Th.; Fl. Br. Ind. i. 39; King Ann. Calc. iii. 199, is a shrub of the Mishmi hills, found by Griffith near the top of Mount Thumathaga.

2. ILLICIUM, Linn.

Four species. *I. manipurense*, Watt; King Ann. Calc. iii. 200, is a tree (King, doubtfully, says *small*, but Watt in Dict. Econ. Prod. iv. 332 says that it is a lofty tree with a stem 30 to 40 ft. high surmounted by a dome of dense bright shining leaves) of high elevations on the Manipur-Burma frontier. *I. majus*, Hook. f. and Th.; Fl. Br. Ind. i. 40; King Ann. Calc. iii. 206, is a small tree of the Thaungyeen Hills of Burma. *I. Simonsii*, Maxim.; King Ann. Calc. iii. 201, is a small tree of the Naga Hills of Assam. They are all aromatic plants, and are occasionally used medicinally. *I. verum*, Hook. f. is known as the "Star-anise" of China.

1. **I. Griffithii,** Hook. f. and Th.; Fl. Br. Ind. i. 40; King Ann. Calc. iii. 201.

A small tree. *Bark* light reddish-brown with vertical lenticels. *Wood* yellowish-brown, close-grained, smooth. *Annual rings* marked by a belt without pores and of a darker colour. *Pores* small, scanty. *Medullary rays* fine, numerous, short.

Bhutan Himalaya; Khasia Hills.
Khasia Hills—Kew Museum (J. D. Hooker).

3. TALAUMA, Juss.

Six species. *T. andamanica*, King; King Ann. Calc. iii. 203, is a shrub or small tree from Mount Harriet, Andamans. *T. Rabaniana*, Hook. f. and Th.; Fl. Br. Ind. i. 40; Kurz For. Fl. i. 24; King Ann. Calc. iii. 204; Vern. *Sappa*, Ass., is a large tree of the Khasia Hills and Burma whose wood is sometimes used in Assam for furniture and planking. *T. mutabilis*, Bl.; Fl. Br. Ind. i. 40; King Ann. Calc. iii. 203 (*T. Candollei*, Bl.; Kurz For. Fl. i. 24), is, according to Kurz, an evergreen shrub of Tenasserim and Tavoy. *T. spongocarpa*, King Ann. Calc. iii. 205, is a moderate-sized tree of the Maymyo Hills in Burma. *T. phellocarpa*, King Ann. Calc. iii. 205, is a tree 60 to 80 feet in height, found in the Sibsagar District, Assam. G. Mann gives its name as *Tita sopa*, but S. E. Peal, who discovered the tree, calls it *Korika sopa*, Ass., and says "The heartwood is large compared to the ring of sapwood, and the 'colour darkish green, turning brown when dry. It is a fine timber for building 'purposes, and can be used not only for posts, but for beams, flooring, and ridge poles, 'wall-plates, etc. It is too valuable to use for boxes" (*Ind. Tea Gaz.*).

No. E 4867 Lakhimpur (F. H. Cavendish) has been sent as the wood of this species. It is a soft grey light (21 lbs. per cubic foot) *wood* with thin grey, smooth *bark*, small regularly distributed *pores*, and close fine *medullary rays*, but scarcely bears out Mr. Peal's description.

No. 4881 Sylhet (Babu Kripa Nath De) has been sent as the wood of *T. Rabaniana*. It is a greyish-white moderately hard *wood*, with thin greyish *bark*, small to moderate-sized, much subdivided *pores* and regular, fine, numerous *medullary rays*: weight 30 lbs. per cubic foot. Vern. *Sappa*. The identification is, however, somewhat doubtful.

1. **T. Hodgsoni,** Hook. f. and Th.; Fl. Br. Ind. i. 40; Hook. f. Ill. Him. Pl. t. 6; Gamble Darj. List 2; King Ann. Calc. iii. 204. Vern. *Siffoo, safun*, Lepcha; *Patpatta, harré*, Nep.; *Laigongron*, Mechi; *Pankakro*, Garo; *Boramthuri*, Ass.

A large evergreen tree. *Bark* grey, ⅓ in. thick, smooth. *Wood* grey, with a grey-black heartwood, soft, even-grained. *Annual rings* distinct. *Pores* small. *Medullary rays* fine and very fine.

Sikkim Himalaya, from the Terai up to 6000 ft., common; Khasia Hills.

A beautiful tree with large terminal white flowers and big cones with bright red seeds. The growth is moderate—7 rings per inch of radius. The wood is used for the handles of knives, such as the Nepalese "kukri" and the Lepcha "ban."

	lbs.
E. 3100. Darjeeling Hills, 5000 ft. (Gamble)	21

4. MAGNOLIA, Linn.

Six species. *M. Gustavi*, King Ann. Calc. iii. 209, is a tall tree discovered by G. Mann in the Makúm Forest, Upper Assam, at about 1–2000 ft.

1. **M. pterocarpa,** Roxb.; King Ann. Calc. iii. 207. *M. sphenocarpa*, Wall; Fl. Br. Ind. i. 41; Kurz For. Fl. i. 24. *Liriodendron grandiflorum*, Roxb. Fl. Ind. ii. 653. Vern. *Boramthuri sopa*, Ass.; *Duli champa*, Sylhet.

A large deciduous tree. *Wood* "white, rather soft, very even in grain right through, and fairly light and strong" (S. E. Peal).

Forest of the tropical Himalaya from Nepal eastward; Khasia and Chittagong Hills.

This tree resembles *Talauma Hodgsoni* in appearance, and its leaves are very large. The sheaths of the young leaves are collected by the Nagas and sold to Assamese, who chew them; the wood is excellent for tea-box shooks, but does not bear exposure to wet if used for planking (S. E. Peal).

2. **M. globosa,** Hook. f. and Th.; Fl. Br. Ind. i. 41; Gamble Darj. List 2; King Ann. Calc. iii. 208. Vern. *Khukie champ*, Nep.

A small deciduous tree. *Bark* light greyish-brown, smooth, with shallow vertical clefts and regular horizontal closely arranged wrinkles. *Wood* white, even-grained, soft to moderately hard. *Annual rings* (?) marked by a white line. *Pores* small, often subdivided or in short radial lines, scanty. *Medullary rays* fine, fairly numerous, inconspicuous.

Sikkim Himalaya at 9–10,000 ft.

A very handsome little tree with beautiful large white flowers in purple bracts, common in bamboo (*Arundinaria racemosa*, Munro) forest.

	lbs.
E 5088. Darjeeling Hills, 10,000 ft. (C. G. Rogers)	36

3. **M. Campbellii,** Hook. f. and Th.; Fl. Br. Ind. i. 41; Hook. f. Ill. Him. Pl. t. 4, 5; Gamble Darj. List 2; King Ann. Calc. iii. 208. Red Magnolia. Vern. *Lal champ*, Nep.; *Sigumgrip, sagok, penré*, Lepcha; *Pendder, patagari*, Bhutia.

A large, tall, deciduous tree. *Bark* dark, branches black. *Wood* white, very soft. *Annual rings* (?) distinctly marked by prominent white lines. *Pores* small. *Medullary rays* moderate-sized, prominent.

Sikkim and Bhutan Himalaya at 8–10,000 ft.

A magnificent tree with beautiful rose-coloured, occasionally white, flowers. It used formerly to be very common, and King says that specimens 150 feet in height were common at the time of Sir Joseph Hooker's visit to Sikkim in 1849; but the demand for building and tea-box woods has made large trees scarce. The beauty of the tree may be well seen by an inspection of the two splendid plates, Nos. 4 and 5 of

Hooker and Cathcart's Illustrations. The wood is used for planking chiefly. Growth moderate, $11\frac{1}{2}$ rings per inch of radius.

	lbs.
E. 365. Rangirúm Forest, Darjeeling, 7500 ft. (Johnston)	25

4. M. Griffithii, Hook. f. and Th.; Fl. Br. Ind. i. 41; King Ann. Calc. iii. 209. Vern. *Bor gahori sopa*, *pan sopa*, Ass.

A large tree. *Bark* thin, greyish-brown, smooth, with many small lenticels. *Wood* greyish-brown, at first sight greatly resembling that of *Ficus*, but with regular alternate layers of dark, fairly hard, and light soft tissue: they may represent annual rings, but this is doubtful. *Pores* small, very scanty, irregularly distributed. *Medullary rays* fine, numerous, rather short.

Valleys of Assam and Cachar.

	lbs.
E 4868. Lakhimpur, Assam (F. H. Cavendish)	28

3. M. Pealiana, King Ann. Calc. iii. 210. Vern. *Gahori sopa*.

A large tree. Outer *bark* dark grey with longitudinal markings; the *wood* "has no heart, but right through is white, soft, and even, 'more or less destitute of ring markings, light, and pretty strong" (S. E. Peal in *Ind. Tea Gaz.*).

Makum forest in Assam.
The wood is used, according to Peal, for tea-boxes.

No. E 4702, sent by H. C. Hill from Dibrugarh, is called *Gahori sopa*. It has an olive-brown heartwood, which resembles closely the wood of *Michelia excelsa*. It has 10 rings per inch of radius, and weighs 40 lbs. per cubic foot, but the difference in colour from Peal's description makes its identification with this species doubtful.

5. MANGLIETIA, Blume.

Two species. *M. Caveana*, Hook. f. and Th.; Fl. Br. Ind. i. 42; King Ann. Calc. iii. 212; Vern. *Phul sopa*, Ass., is a large tree of the lower hills of Assam, possibly only a variety of *M. insignis*.

1. M. insignis, Bl.; Fl. Br. Ind. i. 42; King Ann. Calc. iii. 211. Vern. *Seete soah*, Nep.; *Phul sopa*, Ass.

A very tall, handsome tree. *Bark* thin, greyish-white, smooth. *Wood* yellowish-white, even-grained, smooth, satiny; with numerous concentric lines, narrow and pale, often joining. *Pores* small, scanty. *Medullary rays* fine to moderately broad, not numerous.

Nepal, Sikkim (very scarce), Assam, Khasia Hills, Shan States, usually at 3–6000 ft.

Has a beautiful wood to work, but it does not last in the ground (S. E. Peal). Wallich, in Tent. Fl. Nep. 4, t. 1, says, "It is scarcely possible to contemplate a more 'magnificent object than this noble tree exhibits, both when it is covered with flowers 'and with fruit," and that the wood is pale yellow in colour and close-grained.

Sikkim, 3000 ft.—Kew Museum (J. D. Hooker), marked *M. Caveana*.

6. MICHELIA, Linn.

Ten species. *M. Kisopa*, Ham.; Fl. Br. Ind. i. 43; King Ann. Calc. iii. 217. Vern. *Banchampa*, Kumaon; *Champ*, *chobsi*, Nep., is a tall tree of the Central Himalaya at 5–7000 ft., extending eastwards to Sikkim, where it is rare. A. Aikin,

in his Catalogue of Indian woods collected by Wallich, says the wood is yellowish, is used in Nepal for light works, and has 8 to 11 rings per inch of radius. *M. punduana*, Hook. f. and Th.; Fl. Br. Ind. i. 43; King Ann. Calc. iii. 217, is a large tree of the Khasia Hills at 3–6000 ft. *M. Mannii*, King Ann. Calc. iii. 218, is a rare tree collected only in the Makum forest, Assam, by G. Mann; and *M. montana*, Bl.; King Ann. Calc. iii. 218, is a tree of the Sikkim Himalaya and the Langai forest in Sylhet.

Wood white, grey, yellow, or olive-brown, soft, even-grained. *Annual rings* distinct. *Pores* small or moderate-sized, regular, sometimes in radial lines. *Medullary rays* fine, numerous, uniform, with a good silver-grain.

1. **M. Cathcartii,** Hook. f. and Th.; Fl. Br. Ind. i. 42; Hook. f. Ill. Him. Pl. t. 7; Gamble Darj. List 2; King Ann. Calc. iii. 214. Vern. *Kala champ, titi champ*, Nep.; *Atokdúng*, Lepcha.

A large evergreen tree. *Bark* dark-coloured. *Wood* moderately hard; sapwood large, white; heartwood dark, greenish when wet, when dry olive-brown. *Annual rings* distinctly marked by a white line. *Pores* small. *Medullary rays* fine, not very prominent.

Sikkim Himalaya, common at 5–7000 ft.; Naga Hills.

A pretty tree; flowers white, turning red in drying. The wood is used for planking. Growth about 8 to 9 rings per inch of radius.

		lbs.
E 2314.	Rangbúl Forest, Darjeeling, 6500 ft. (Gamble) . . .	41
E 3321.	Darjeeling, 6500 ft. (Gamble)	—

2. **M. lanuginosa,** Wall.; Fl. Br. Ind. i. 43; Gamble Darj. List 3; King Ann. Calc. iii. 215. Vern. *Gogay champ*, Nep.

A large deciduous tree. *Bark* $\frac{1}{3}$ in. thick, greyish-brown, smooth. *Wood* greyish-white, soft, shining. *Annual rings* doubtful. *Pores* small, scanty. *Medullary rays* fine and very fine, closely packed.

Eastern Himalaya from Nepal to Bhutan at 5–7000 ft., common about Darjeeling; Khasia Hills.

Wood little used. Weight about 31 lbs. per cubic foot. Growth fast, about 6 rings per inch radius.

		lbs.
E 3099.	Darjeeling, 7000 ft. (Gamble)	27
E 3331	„ 6000 „ „	36

3. **M. excelsa,** Bl.; Fl. Br. Ind. i. 43; Gamble Darj. List 3; King Ann. Calc. iii. 215. Vern. *Bara champ, safed champ, seti champ*, Nep.; *Sigugrip, penré*, Lepcha; *Gók*, Bhutia.

A lofty deciduous tree. *Bark* greyish-brown, $\frac{1}{3}$ in. thick. *Wood* soft: sapwood small, white or grey; heartwood olive-brown, glossy, yellow when freshly cut. *Annual rings* distinctly marked by firmer autumn wood with fewer pores. *Pores* small, evenly distributed, sometimes subdivided. *Medullary rays* rather long, fine and moderately broad, very numerous, showing a satiny silver-grain.

Forests of the Eastern Himalaya at 6–8000 ft.; Khasia Hills.

The most important building tree of the Upper Darjeeling Forests, formerly used largely for planking, door and window frames, and furniture, but now scarce; a bad fuel and having an unpleasant smell when freshly cut. Growth variable; young trees show often only 4 to 7 rings per inch of radius, older ones 12 to 16, while a round (E 3631) in the Darjeeling Forest Museum with a girth of 91 in. gave 7 rings per inch mean growth. In the Darjeeling Forest Working Plan the mean rate of growth

is given as 8 to 11 rings per inch, and the rotation is fixed at 160 years. Weight 33 to 34 lbs. per cubic foot. The wood is very durable: *e.g.* specimen No. E 1442 was cut in 1836 and kept in Calcutta uncut till 1878, when it was found to be quite sound. The tree has been largely planted, its natural reproduction being somewhat difficult, partly because it requires some shade for germination and then light, without danger of being choked by weeds, partly because wherever grazing is permitted the cattle eat the seedlings freely. It seeds profusely; the seeds are usually good, and if sown at once germinate well, so that nursery propagation is not difficult. But they are very oily, and difficult to keep or send to a distance.

	lbs.
E 657. Chuttockpur Forest, Darjeeling, 6000 ft. (Johnston)	33
E 2312. Rangbúl Forest, Darjeeling, 7000 ft. (Gamble)	33
E 1442. Mishmi Hills (Griffith 1836)	34
E 3586, 3631. Darjeeling, 7000 ft. (Gamble)	—
Nordlinger's Sections, vol. 8.	

4. M. Champaca, Linn.; Fl. Br. Ind. i. 42; Roxb. Fl. Ind. ii. 656; Bedd. Fl. Sylv. vi.; Brandis For. Fl. 3; Kurz For. Fl. i. 25; Gamble Darj. List 3; Talbot Bomb. List 2; Trimen Fl. Ceyl. i. 15; King Ann. Calc. iii. 216. Vern. *Champa*, Hind.; *Oulia champ*, Nep.; *Tita sopa*, Ass.; *Champa, champaca*, Beng.; *Shimbu, sempangam, chambagam*, Tam.; *Champakamu, sampenga, kanchanamu*, Tel.; *Sampige, kola sampige*, Kan.; *Kud champa*, Mar.; *Champakam*, Mal.; *Saga, sagawa*, Burm.; *Sapu, hapu*, Cingh.

A tall evergreen tree. *Bark* grey, smooth, ½ in. thick. *Wood* soft, even-grained: sapwood white, heartwood light olive-brown. *Annual rings* distinctly marked by a dark line. *Pores* moderate-sized, evenly distributed, often subdivided into 2 to 5 by thin partitions. *Medullary rays* regular, fine and moderately broad, numerous, showing a satiny silver-grain of narrow dark plates.

Cultivated throughout India from the Ravi southwards and up to 5500 ft. in the Western Himalaya. Wild in Nepal, the Eastern Himalaya, and Assam up to 3000 ft., also in Burma and perhaps in the Western Ghâts.

A beautiful tree, much cultivated about Jain and Hindu temples and prized on account of its scented flowers. In the forest it has a cylindrical stem, and reaches 8 to 10 ft. in girth. Beddome mentions one on the Balarangam Hills in Mysore which had over 50 feet in circumference. The specimens examined show an average growth of 6 to 7 rings per inch of radius. S. E. Peal says that the wood of *Tita sopa* is intensely bitter, and that "it seems not unlikely that the lasting quality of the wood 'is due to a bitter deliquescing salt, that prevents rot; old posts are often on removal 'found to be as wet inside as the day they were put in" (*Ind. Tea Gaz.*). The wood is very durable; *e.g.* specimen No. 1437 was cut by Griffith in 1836, and when after storage for 42 years in Calcutta it was cut into, it was found perfectly sound. In N. Bengal it is used for planking, door-panels and furniture; in Assam for building and canoes; elsewhere for house and carriage building and native drains. The bark is said to have been used as a febrifuge, but is now rarely used; the flowers and seeds also are occasionally used in medicine. The flowers are used in religious ceremonies. The wood is made into beads, and necklaces of the beads are sold to pilgrims at Hardwar.

Weight and strength: Brandis' experiments of 1864 with Nepal wood gave weight 37 lbs. per cubic foot, four trials with bars 6′ × 2″ × 2″ gave P = 564, and three with bars 6′ × 2″ × 1½″ gave P = 561. Puckle's experiments in Mysore with bars 2′ × 1″ × 1″ gave weight 42 lbs., P = 642. The average of the specimens examined gives 36 lbs. for weight per cubic foot. The average weight may be taken at 37 lbs. The experiments on Ceylon wood made by Prof. W. C. Unwin, F.R.S., for the Imperial Institute (*Imp. Inst. Journal*, May, 1899), gave the following results:—

Weight	41·41 lbs. per cub. foot.
Resistance to shearing along the fibres	753 lbs. per sq. inch.
Crushing stress	1·570 tons per sq. inch.
Transverse strength, coefficient of	3·488 „ „
Coefficient of elasticity	502·15 „ „

		lbs.
E 576.	Khookloong Forest, Darjeeling Terai (Manson)	35
E 2313.	Sukna Forest, „ „ (Gamble)	37
E 5110.	Tista Valley, Darjeeling (C. G. Rogers)	28
E 2195.	Nowgong, Assam (Mann)	40
E 1049.	Eastern Dúars, Assam (Mann)	36
E 1437.	Mishmi Hills (Griffith, 1836)	42
E 4704.	Dibrugarh, Assam (H. C. Hill)	29
Ceylon, Collection, No. 123, new (Mendis)		42

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5. **M. nilagirica,** Zenk.; Fl. Br. Ind. i. 44; Bedd. Fl. Sylv. t. 62; King Ann. Calc. iii. 216; Trimen Fl. Ceyl. i. 14. Vern. *Pila champa*, Hind., Mar.; *Shembugha*, Tam.; *Wal-sapu*, Cingh.

A large tree. *Bark* brown, ½ in. thick, cleft, but not deeply, into small rectangular plates. *Wood* moderately hard, smooth: sapwood grey, heartwood olive-brown, glossy, yellow when fresh, and at first turning blue on contact with the saw. *Annual rings* marked by a fine pale line. *Pores* small, not very numerous, often in lines or groups of 3 to 4. *Medullary rays* fine, numerous, showing as parallel horizontal plates in the silver-grain.

Higher mountains of South India and Ceylon above 5000 ft.; common in Nilgiri "sholas."

A handsome tree and valuable for house-building in the Nilgiri and other S. Indian ranges: much used in Ceylon, and worthy of cultivation. Trimen says, "One 'of the best of the mountain timbers. One sort (variety) is often called by carpenters ''*Wal-buruta*,' and distinguished from the ordinary '*Wal-sapu*' by darker colour and 'greater weight. This was the '*Buruta*' wood used for sleepers on the Nanu-oya 'Railway." Growth slow, 16 to 18 rings per inch of radius. The bark is reported to have been formerly used as a febrifuge. The leaves also are accounted antipyretic (Ind. Agt., Dec. 11, 1886).

		lbs.
W 3879.	Aramby Forest, Nilgiris, 7000 ft. (Gamble)	38
Ceylon Collection, No. 147, new (Mendis)		—

6. **M. oblonga,** Wall.; Fl. Br. Ind. i. 43; King Ann. Calc. iii. 217. Vern. *Sopa*, *phul-sopa*, *bor-sopa*, Ass.

A very large tree. *Bark* whitish-grey. *Wood* white or greyish-white, soft. *Annual rings* marked by a definite white or pale line adjoining the harder autumn wood. *Pores* moderate-sized, often in short radial lines or subdivided into 2 or 3. *Medullary rays* fine, uniform, closely packed, distinct.

Assam, Khasia Hills and Sylhet, in lower forests.

A useful wood, extensively used for tea-boxes, also for canoes and rough furniture. S. E. Peal says, "Occasionally *Bor sopa* trees run so large that they would easily cut 'to 250 tea-chests from the one stem, allowing liberally for waste; but such trees 'are actually too large to cut up profitably unless near a large saw-frame. Towards 'the east of Assam this tree attains a height of 80 ft. in the shaft and 150 to the 'crown, with a girth of 13 and 14 ft. at 10 ft. up. One tree would suffice to floor a 'bungalow 60′ × 40′ with 1¼″ planks" (*Ind. Tea Gaz.*). Weight about 40 lbs. per cubic foot.

		lbs.
E 1268.	Lakhimpur, Assam (Mann)	40
E 4703.	Dibrugarh, Assam (H. C. Hill)	36

This latter specimen was received at Dehra Dún under the name "*phul-sopa.*"

7. SCHIZANDRA, Michaux.

Climbing glabrous shrubs, of which four species are described. *S. elongata*, Hook. f. and Th. is found in the Eastern Himalaya; *S. propinqua*, Hook. f. and Th., in the Central Himalaya in Nepal and Kumaon, extending west to the Jumna; and *S. axillaris*, Hook. f. and Th., in the Khasia Hills and the Shan Hills in Burma.

1. S. grandiflora, Hook. f. and Th.; Fl. Br. Ind. i. 44; Brandis For. Fl. 571; Gamble Darj. List 3; King Ann. Calc. iii. 219. Vern. *Klandru, kaljendru*, Simla; *Banoi*, Jaunsar; *Sillangti, sirkúl*, Kumaon; *Singhata*, Nep.; *Taksielrik*, Lepcha.

A woody climber. *Bark* papery, light brown. *Wood* soft. *Pores* large. *Medullary rays* broad. Has a strong resinous odour.

Forests of the Himalaya from Simla to Bhutan at 6–10,000 ft. Very common in Jaunsar, also at Darjeeling.

H 3029. Nagkanda, 9000 ft. (Gamble).

8. KADSURA, Kaempfer.

Two climbing shrubs. *K. Wightiana*, Arn. is found in the forests of Malabar and Ceylon at 2–3000 ft. Trimen says that "the old stems often develop thick prominent 'wings of soft cork."

1. K. Roxburghiana, Arn.; Fl. Br. Ind. i. 45; Gamble Darj. List 3; King Ann. Calc. iii. 222.

A large climbing shrub. *Bark* brown, thick, corky, deeply cleft. *Wood* yellowish-brown, soft, porous. *Pores* moderate-sized to large, scanty. *Medullary rays* moderately broad, not numerous.

Tropical Eastern sub-Himalayan forests; Assam. The fruit is sometimes eaten.
Soormale river, Assam—Kew Museum (J. D. Hooker).

ORDER IV. ANONACEÆ.

An Order containing only woody plants, and found almost entirely in tropical regions only. It is a very "natural" Order, not only in its unmistakable outward botanical characters, but in the structure of the wood. It contains, in the region herein dealt with, 21 genera and about 127 species—trees, shrubs, or climbing woody plants. Since the publication of the Fl. Br. Ind., the Order has been carefully and fully revised by Sir G. King, K.C.I.E., F.R.S., whose Monograph forms vol. iv. of the "Annals of the Royal Botanic Garden of Calcutta." The genera are grouped in five Tribes, viz.—

Tribe	I. Uvarieæ	Sageræa, Uvaria, Ellipeia.
„	II. Unoneæ	Cyathocalyx, Artabotrys, Canangium, Unona, Polyalthia, Anaxagorea.
„	III. Mitrephoreæ	Goniothalamus, Orophea, Mitrephora, Popowia, Oxymitra.
„	IV. Xylopieæ	Melodorum, Xylopia, Anona.
„	V. Miliuseæ	Phæanthus, Miliusa, Saccopetalum, Alphonsea.

One genus, *Anona*, contains only introduced fruit trees; the others chiefly trees of the moist evergreen forests of Burma, Eastern Bengal, the Malabar Coast and Ceylon. Only a few species extend to Northern or even to the drier regions of Central India. The woods of the Custard-apple Order are not important, but some of them are useful and suitable for furniture- or carving-work.

Wood pale-coloured, usually yellowish or grey, soft to moderately

hard, even-grained; traversed by narrow, pale concentric bands which form ladder-like cross-bars between the medullary rays. *Annual rings* rarely distinguishable. *Pores* small to moderate-sized, rather scanty, often radially subdivided or in strings. *Medullary rays* fine to moderately broad or broad, regular. The concentric bars are formed by lines of wood-cells larger than in the rest of the cellular tissue.

Tribe I. UVARIEÆ.

1. SAGERÆA, Dalz.

This genus contains four species. *S. elliptica*, Hook. f. and Th.; King Ann. Calc. iv. 6 (*Bocagea elliptica*, Hook. f. and Th.; Fl. Br. Ind. i. 92; Kurz For. Fl. i. 50), is a large evergreen tree of Tenasserim. *S. Listeri*, King Ann. Calc. iv. 7, is a tree of the Chittagong Hill Tracts. *S. Thwaitesii*, Hook, f. and Th.; Bedd. Fl. Sylv. viii.; King Ann. Calc. iv. 7 (*Bocagea Thwaitesii*, Hook. f. and Th.; Fl. Br. Ind. i. 92; Trimen Fl. Ceyl. i. 33), is a tree endemic in the lower moist country of Ceylon.

1. **S. laurina,** Dalz.; Bedd. Fl. Sylv. viii.; King Ann. Calc. iv. 7. *S. Dalzellii*, Bedd. Fl. Sylv. viii. *Bocagea Dalzellii*, Hook. f. and Th.; Fl. Br. Ind. i. 92; Talbot Bomb. List 6. Vern. *Sajeri, kochrik, har-kinjal, undie*, Mar.; *Nedu natta*, Tel.; *Kanakayitha*, Trav. Hills.

A middle-sized tree. *Wood* light yellow, sometimes red, hard, even-grained, rather heavy; cross-bars prominent, not numerous, many, regular. *Pores* moderate-sized to large, very scanty, often filled with a white substance. *Medullary rays* moderately broad, long, not numerous but very regular.

Konkan, Kanara and Travancore forests.

The wood is handsome and looks likely to be useful for cabinet work. Bourdillon's experiments in 1896 gave: Weight 49 lbs., P = 788; he says the wood is tough and elastic and used for shafts. Annual rings about 7 per inch. The leaves are used as a fomentation in rheumatism (Pharm. Ind.).

		lbs.
W 4587.	Travancore (Bourdillon)	47

2. UVARIA, Linn., is a genus of 16 scandent or sarmentose shrubs, of which the three following are probably the most important. *U. Hamiltonii*, Hook. f. and Th.; Fl. Br. Ind. i. 48; Gamble Darj. List 3; King Ann. Calc. iv. 17, is a powerful climber of the N. and E. Himalaya, Assam, E. Bengal, Shan Hills and Andamans. *U. macrophylla*, Roxb. Fl. Ind. ii. 663; Fl. Br. Ind. i. 49; Kurz For. Fl. i. 28; Trimen Fl. Ceyl. i. 18; King Ann. Calc. iv. 19. Vern. *Bagh-runga*, Beng.; *Thabut*, Burm., is a widely distributed species of E. Bengal, Burma and Ceylon. *U. Narum*, Wall.; Fl. Br. Ind. i. 50; Talbot Bomb. List 3; Trimen Fl. Ceyl. i. 19; King Ann. Calc. iv. 27; Vern. *Narum panel*, Mal., is a large climber common in the Konkan, Kanara, Malabar and Ceylon forests.

3. ELLIPEIA, Hook. f. and Th. *E. costata*, King Ann. Calc. iv. 34 (*Polyalthia costata*, Hook. f. and Th.; Fl. Br. Ind. i. 67), is a shrub about 10 ft. high found on the Moolyet Hill in Tenasserim at 5000 ft.

Tribe II. UNONEÆ.

4. CYATHOCALYX, Champion.

Two species. *C. martabanicus*, Hook. f. and Th.; Fl. Br. Ind. i. 53; Kurz For. Fl. i. 30; King Ann. Calc. iv. 36, is a small evergreen tree of tropical forests from Martaban to Tenasserim, with, according to King, "a white, fibrous but rather close-grained, perishable wood."

1. C. zeylanicus, Champ.; Fl. Br. Ind. i. 53; Bedd. Fl. Sylv. ix.; Trimen Fl. Ceyl. i. 20; King Ann. Calc. iv. 36. Vern. *Kékala, ipetta*, Cingh.

A tall tree. *Bark* smooth. *Wood* yellowish-white, moderately hard, with very prominent cross-bars, not regularly concentric but generally so, about 120 per inch. *Pores* large, extremely scanty. *Medullary rays* fine to moderately broad, not regular, not numerous, prominent.

Western Coast and Western Gháts, in Malabar, Travancore and the Anamalais; forests of the moist low country of Ceylon at 1500–3000 ft.

Trimen says that this tree is very straight, often attaining an immense height, with slender, horizontal or deflexed branches. The wood is used for the lacquered sticks carried by Kandyan chiefs.

Ceylon: Int. Exhn., 1862—Kew Museum.

5. ARTABOTRYS, R. Brown, contains eight large scandent shrubs, the most important one of which is *A. odoratissimus*, R. Br.; Fl. Br. Ind. i. 54; Kurz i. 31; Talbot Bomb. List 3; Trimen Fl. Ceyl. i. 21; King Ann. Calc. iv. 44, a large erect or scandent shrub indigenous in S. India and Ceylon, and largely cultivated in other parts of India for its fragrant flowers. *A. zeylanicus*, Hook. f. and Th.; Fl. Br. Ind. i. 54; Talbot Bomb. List 3; Trimen Fl. Ceyl. i. 22; King Ann. Calc. iv. 43; Vern. *Petika-wel, yakada-wel*, Cingh., is a large climber with compressed stems common in the evergreen forests of the Western Coast and the moist region of Ceylon.

6. *CANANGIUM*, *Baill.*

1. C. odoratum. Baill.; King Ann. Calc. i. 51. *Cananga odorata*, Hook. f. and Th.; Fl. Br. Ind. i. 56; Kurz For. Fl. i. 33. *Uvaria odorata*, Roxb. Fl. Ind. ii. 661. Ilang-ilang. Vern. *Kadatnyan*, Burm.

A tree. *Wood* grey, light, soft, with the ladder-like cross-bars rather distant. *Pores* large, very scanty, often subdivided by 2 to 5 bars across them. *Medullary rays* moderately broad, giving a conspicuous silver-grain.

Tenasserim: elsewhere cultivated for its very strongly scented flowers which give the well-known "Ilang-ilang" perfume. Roxburgh says that it was introduced in 1797 from Sumatra into the Calcutta garden.

		lbs.
D 4133.	Agri-Horticultural Gardens, Madras (Steavenson)	19

7. UNONA, Linn.

Contains eleven species of trees, shrubs or climbers. *U. elegans*, Thw. and *U. zeylanica*, Hook. f. and Th. are shrubs of Ceylon only. *U. pannosa*, Dalz.; Fl. Br. Ind. i. 58; Bedd. Fl. Sylv. ix.; King Ann. Calc. iv. 55, is a tree of the forests of the Konkan, Kanara and Malabar, up to 3500 ft., which "gives a valuable strong fibre" (Beddome). *U. Desmos*, Dunal. is an evergreen shrub of Burma. *U. discolor*, Vahl; Vern. *Tanatsa*, Burm., is a spreading shrub found throughout N.E., S. and W. India and in Burma. *U. viridiflora*, Bedd., is a gigantic climber of the Anamalai hills and Travancore; and *U. Lawii*, Hook. f. and Th. a climber of the West Coast. *U. latifolia*, Hook. f. and Th.; Fl. Br. Ind. i. 60; Kurz For. Fl. i. 35; King Ann. Calc. iv. 58, is a tree found by Brandis in the hill forests on the Salween river in Burma. *U. præcox*, Hook. f. and Th.; Fl. Br. Ind. i. 60; King Ann. Calc. iv. 58, is a tree of the Mikir Hills in Assam. *U. Dasymaschala*, Bl. is an erect or sarmentose shrub of Burma and the Andamans.

1. U. longiflora, Roxb. Fl. Ind. ii. 668; Fl. Br. Ind. i. 61; Kurz For. Fl. i. 35; King Ann. Calc. iv. 58.

A small tree. *Bark* greenish-grey, thin, smooth. *Wood* yellowish-white, moderately hard, close-grained; ladder-like bars white,

numerous. *Pores* small, scattered, scanty. *Medullary rays* moderately broad.

Assam, Khasia Hills, and Chittagong forests, remarkable for having flower petals often 6 in. long.

E 3368. Kasalong Forest, Chittagong Hill Tracts (Gamble).

8. POLYALTHIA, Bl.

In this genus come about 14 trees or shrubs. Besides those specifically mentioned below, there are others of some note. *P. acuminata*, Thw., *P. persicifolia*, Bth. and Hook. f., and *P. Moonii*, Thw. are Ceylon endemic trees or shrubs. *P. coffeoides*, Bth. and Hook. f.; Fl. Br. Ind. i. 62; Talbot Bomb. List 4; Trimen Fl. Ceyl. i. 24; King Ann. Calc. iv. 67; Vern. *Nedunarai*, Tam.; *Villa*, Trav. Hills; *Omaru*, Cingh., is a large tree of the Western Ghâts and Ceylon, having the flowers usually from the trunk. *P. Jenkinsii*, Bth. and Hook. f.; Fl. Br. Ind. i. 64; King Ann. Calc. iv. 70, is a tree of Assam and Eastern Bengal. *P. simiarum*, Bth. and Hook. f.: Fl. Br. Ind. i. 63, is a tree of Eastern Bengal, Burma, and the Andamans; and *P. obliqua*, Hook. f. and Th. a tree of the Chittagong Hill Tracts. *P. Korinti*, Bth. and Hook. f.; Fl. Br. Ind. i. 64; Trimen Fl. Ceyl. i. 25; King Ann. Calc. iv. 79; Vern. *Uluvintai*, Tam.; *Miwenna*, Cingh., is a shrub of the Coromandel coast from Vizagapatam southwards and Ceylon. *P. rufescens*, Hook. f. and Th. is a tree of Cochin.

1. **P. suberosa,** Bth. and Hook. f.; Fl. Br. Ind. i. 65; Brandis For. Fl. 5; Talbot Bomb. List 4; Trimen Fl. Ceyl. i. 25; King Ann. Calc. iv. 64. *Uvaria suberosa*, Roxb. Fl. Ind. ii. 667. Vern. *Bara chali*, Beng.; *Banderhola*, Ass.; *Chilka dúdúga*, Tel.; *Sandi omé*, Kól; *Kuradia*, Uriya; *Kalati*, Cingh.

A small evergreen tree or shrub. *Bark* very thickly corky, brown. *Wood* close-grained, hard, tough and durable, olive-grey; the ladder-like bars very numerous, fine, distinct, equidistant. *Pores* small. *Medullary rays* short, broad or moderately fine.

Oudh, Bengal, the Konkan, and South India, common along ravines in dry forests like the scrub of the Circars and Carnatic; Ceylon, on the south-west wet coast.

Weight about 40 lbs. per cubic foot (Brandis).

C 3483. Kolhan Forests, Singbhúm (Gamble).

2. **P. cerasoides,** Bth. and Hook. f.; Fl. Br. Ind. i. 63; Brandis For. Fl. 5; Bedd. Fl. Sylv. t. 1; Kurz For. Fl. i. 38; Talbot Bomb. List 4; King Ann. Calc. iv. 65. *Uvaria cerasoides*, Roxb. Fl. Ind. ii. 666. Vern. *Hoom*, Mar.; *Vubbina*, Kan.; *Gutti, chilka dúdúga*, Tel.; *Nakulsi, múlili, nublay*, Tam.

An evergreen tree. *Bark* rough, grey, ¼ in. thick. *Wood* olive-grey, moderately hard, close-grained, with extremely numerous distinct bars, 250–300 per inch. *Pores* small, scanty. *Medullary rays* moderately broad or broad, short, with a good silver-grain.

Behar, Eastern and Western Ghâts, Deccan, Burma. Chiefly found in dry forests, but occasionally in the wet evergreen.

Wood said to be used in carpentry and for boat-building. H. H. O'Connell's Madras experiments of 1886 gave: W = 47 lbs., and α = 0·00845; specimen examined gives W = 52 lbs. per cubic foot.

		lbs.
C 997.	Poona (Shuttleworth)	52
D 3872.	Nigadi Hills, Cuddapah, Madras (Gamble)	—

3. **P. andamanica,** Kurz; King Ann. Calc. iv. 67. *P. Jenkinsii*, Bth. and Hook. f.; Fl. Br. Ind. i. 64 (in part); Kurz For. Fl. i. 37. Vern. *Thanlúng*, Burm.

A small tree. *Wood* grey; cross-bars numerous, faint. *Pores* small, often subdivided. *Medullary rays* moderately broad, the

distance between them many times larger than the transverse diameter of the pores.

Andaman Islands.

		lbs.
B 2281.	Andamans (Col. Ford, 1866)	32

(The identification of this wood is not quite certain.)

4. **P. longifolia**, Bth. and Hook f.; Fl. Br. Ind. i. 62; Brandis For. Fl. 4; Bedd Fl. Sylv. t. 38; Trimen Fl. Ceyl. i. 24; King Ann. Calc. iv. 72. *Uvaria longifolia* Lam.; Roxb. Fl. Ind. ii. 664. Vern. *Asok, debdari,* Hind.; *Assothi, mara-illupai* Tam.; *Asoka, devadaru,* Tel.; *Choruna, aruna,* Mal.

A large evergreen tree. *Bark* smooth, dark greyish-brown. *Wood* white, yellowish-white or greyish-white; the cross-bars extremely numerous, equidistant, rather faint. *Pores* small to moderate-sized rather scanty, often subdivided, uniformly distributed. *Medullary rays* short, fine to broad, the distance between them about equal to the diameter of the pores.

Ceylon, also (according to Wight) in Tanjore. Elsewhere cultivated as an ornamental tree, as which it undoubtedly is one of the finest in India. Fine avenues may be seen in most Government Gardens, as at Calcutta (Royal Botanic, Zoological, and Eden Gardens; Barrackpore Park, etc.), in the Taj Gardens at Agra, and elsewhere; also on private estates and along roads.

As its name indicates, it is held in great value by Hindus, and planted near temples by them.

The wood is useful for some purposes, and in Madras it has been used by the Ordnance and Commissariat Depts. for barrels, as it is tough and bends easily. Weight: according to Skinner, No. 76, 37 lbs.; Brandis says "between 30 and 48;" specimen examined gives 37 lbs. Skinner's experiments give P = 547.

		lbs.
E 2479.	Calcutta Bot. Garden (King)	37
D 3970.	Madras (Gamble)	—

5. **P. fragrans**, Bth. and Hook. f.; Fl. Br. Ind. i. 63; Talbot Bomb. List 4; King Ann. Calc. iv. 73. Vern. *Gauri,* Kan.; *Nedu nár,* Mal.; *Chela, udambatti, kodanyi,* Trav. Hills.

A tree. *Wood* greyish-white, moderately hard; the cross-bars exceedingly numerous and regular. *Pores* rather small, very scanty. *Medullary rays* moderately broad, unequal, giving a conspicuous silver-grain.

Forests of the S. Konkan, Kanara, and Malabar.

Bourdillon says the wood is used for masts; he determined W = 41 lbs. per cubic foot, P = 567.

		lbs.
W 4593.	Travancore (Bourdillon)	39

9. ANAXAGOREA, St. Hilaire. *A. luzonensis*, A. Gray; Fl. Br. Ind. i. 68; Kurz For. Fl. i. 39; Trimen Fl. Ceyl. i. 27; King Ann. Calc. iv. 85, is a shrub of Burma, the Andamans and Ceylon, with smooth reddish-grey bark.

TRIBE III. MITREPHOREÆ.

10. GONIOTHALAMUS, Bl.

About 13 small trees or shrubs of little importance. Of these 7 are described by Trimen as occurring in Ceylon, 6 of them being endemic.

G. Wightii, Hook. f. and Th. is a small tree of Tinnevelly and Travancore; *G. wynaadensis*, Bedd. a shrub of the Wynaad, and *G. cardiopetalus*, Hook. f. and Th. a shrub or small tree of Kanara, North Wynaad, and the Anamalais. *G. Simonsii*, Hook. f.

and Th. is a small tree of the Khasia Hills, and *G. Griffithii*, Hook. f. and Th. a large shrub or small tree of Mergui in Burma. *G. peduncularis*, King and Prain, is found in Upper Burma.

1. **G. Thwaitesii**, Hook. f. and Th.; Fl. Br. Ind. i. 72; Bedd. Fl. Sylv. viii.; Trimen Fl. Ceyl. i. 29; King Ann. Calc. iv. 88. Vern. *Kalukèra*, Cingh.

A small or moderate-sized tree. *Bark* smooth. *Wood* yellowish-white, soft; the cross-bars very numerous, faint. *Pores* small or moderate-sized, often in pairs, scanty. *Medullary rays* moderately broad to broad, not numerous, but giving a good silver-grain of speckled plates.

Travancore and Tinnevelly in South India; lower hills of Ceylon.

Ceylon: Int. Exhn., 1862—Kew Museum.

2. **G. sesquipedalis**, Hook. f. and Th.; Fl. Br. Ind. i. 73; Kurz For. Fl. i. 41; Gamble Darj. List 3; King Ann. Calc. iv. 98. Vern. *Sané*, Nep.; *Singnok*, Lepcha.

A small shrub. *Bark* black. *Wood* dark grey, soft; the cross-bars very numerous, very fine. *Pores* extremely small. *Medullary rays* fine to moderately broad, wavy.

Tropical forests of the Sikkim Himalaya, Assam and Burma, in undergrowth.

E 3300. Chunbati, Darjeeling, 2000 ft. (Gamble).

11. OROPHEA, Blume, contains 10 small trees or shrubs. Three of these, *O. uniflora*, Hook. f. and Th., *O. Thomsoni*, Bedd. and *O. erythrocarpa*, Bedd., are small trees of S. India, chiefly in the Western Ghâts. *O. zeylanica*, Hook. f. and Th. is a small tree of the W. Ghâts and Ceylon. *O. obliqua*, Hook. f. and Th.; King Ann. Calc. iv. 110 (*Bocagea obliqua*, Hook. f. and Th.; Fl. Br. Ind. i. 93; Trimen Fl. Ceyl. i. 33) and *O. coriacea*, Thw.; King Ann. Calc. iv. 109 (*Bocagea coriacea*, Hook. f. and Th.; Fl. Br. Ind. i. 93; Trimen Fl. Ceyl. 34); Vern. *Keku*, Cingh., are small trees endemic in Ceylon, the latter common and having a bark which is used for tying packages. *O. Katschallica*, Kurz, is a small tree of the Nicobar Islands. *O. Brandisii*, Hook. f. and Th., *O. hexandra*, Bl. and *O. polycarpa*, A. DC are small trees of Burma, the last extending to the Andamans.

12. MITREPHORA, Bl.

Six species. *M. tomentosa*, Hook. f. and Th.; Fl. Br. Ind. i. 76; Kurz For. Fl. i. 44; King Ann. Calc. iv. 111, is a tree of the forests of Assam, Chittagong and Pegu, at the bases of the hill ranges. *M. grandiflora*, Bedd.; Fl. Br. Ind. i. 78; Bedd. Fl. Sylv. t. 75; King Ann. Calc. iv. 112, is a large handsome tree of the S. Kanara ghât forests with a tough wood. *M. Heyneana*, Thw.; Fl. Br. Ind. i. 77; Trimen Fl. Ceyl. i. 32; King Ann. Calc. iv. 113, is a small or medium-sized tree of the base of the Tinnevelly Hills in S. India and the dry country of Ceylon. *M. reticulata*, Hook. f. and Th.; Fl. Br. Ind. i. 77; Kurz For. Fl. i. 44; King Ann. Calc. iv. 113, is a small tree of Tenasserim. *M. Prainii*, King Ann. Calc. iv. 115, is a tree of the Andaman Islands.

1. **M. Maingayi**, Hook. f. and Th.; Fl. Br. Ind. i. 77. *M. obtusa*, Bl.; Fl. Br. Ind. i. 76. *M. vandæflora*, Kurz For. Fl. i. 45.

A deciduous tree. *Wood* grey, moderately hard; cross-bars numerous, regular. *Pores* small to moderate-sized, not numerous. *Medullary rays* moderately broad.

Chittagong and Burma, chiefly in the Martaban Hills.

B 3380. Toungoo Hills (Kurz).

13. POPOWIA, Endl. contains five species. *P. nitida*, King Ann. Calc. iv. 118 is a shrub of the Andaman and Nicobar Islands; and two others are found also in the Andamans, but extend in addition to Tenasserim. These are *P. Helferi*, Hook. f. and Th.; Fl. Br. Ind. i. 69; Kurz For. Fl. i. 39; King Ann. Calc. iv. 118, and *P. Kurzii*

King (*Polyalthia macrophylla*, Hook. f. and Th.; Fl. Br. Ind. i. 66. *P. dubia*, Kurz For. Fl. i. 38). *P. Beddomeana*, Hook. f. and Th.; Fl. Br. Ind. i. 68; King Ann. Calc. iv. 119 (*P. ramosissima*, Bedd. Fl. Sylv. viii.) is a small tree of S. Tinnevelly and S. Travancore. *P. Hookeri*, King; Ann. Calc. iv. 123 (*P. argentea*, Hook. f. and Th.; Fl. Br. Ind. i. 67) is a shrub or small tree of the forests of Assam, Sylhet, the Khasia and Naga Hills.

14. OXYMITRA, Blume, contains three climbing shrubs: *O. fornicata*, Hook. f. and Th. of Assam and Chittagong and two of the forests of Burma, of no great importance.

Tribe IV. XYLOPIEÆ.

15. MELODORUM, Dunal. is a genus of about six climbing shrubs and one tree. Of the climbers, five are found in Assam and Eastern Bengal, and one in Burma; the chief one being *M. polyanthum*, Hook. f. and Th.; Fl. Br. Ind. i. 81; King Ann. Calc. iv. 131, which is a large climber found in the forests from Assam through the Khasia Hills and Sylhet to the Chittagong Hill tracts. *M. macranthum*, Kurz For. Fl. i. 42; King Ann. Calc. iv. 140, is a rather rare evergreen tree of the forests of S. Andaman.

16. XYLOPIA, Linn.

This genus contains three Ceylon trees, one of which extends to South India. *X. nigricans*, Hook. f. and Th.; Fl. Br. Ind. i. 84; Trimen Fl. Ceyl. i. 28; King Ann. Calc. iv. 147, is an erect tree of the low country of Ceylon with smooth bark. *X. Championii*, Hook. f. and Th.; Fl. Br. Ind. i. 84; Trimen Fl. Ceyl. i. 28; King Ann. Calc. iv. 149; Vern. *Dat-kétiya*, Cingh., is a tree common in the moist low country of Ceylon with brown bark.

1. **X. parvifolia,** Hook. f. and Th.; Fl. Br. Ind. i. 84; Bedd. Fl. Sylv. t. 172; Trimen Fl. Ceyl. i. 28; King Ann. Calc. iv. 145. Vern. *Netawu*, *atukétiya*, Cingh.

A lofty tree. *Bark* light yellowish-brown, smooth (young plant). *Wood* white or greyish-white, moderately hard to hard; cross-bars numerous, prominent, regular, about 170 per inch, not regularly concentric. *Pores* moderate-sized to large, scanty, prominent on the longitudinal sections, often in twos or threes, or much subdivided. *Medullary rays* white, fine, clearly marked, irregular.

Travancore forests; Ceylon, in the moist low country.

A handsome straight tree. Bourdillon's experiments with the wood gave weight 45 lbs., P = 725. Trimen, quoting Thwaites, says that "the bark, especially of the 'root, the flowers, and the fruit are all very sweet-scented and aromatic, and are chewed 'with betel."

W 4528 and W 4597.	Travancore (Bourdillon)	lbs 35 and 47
	Ceylon—Kew Museum (S. Jayeteleke).	

17. ANONA, Linn.

This genus contains four introduced fruit trees, one of which, *A. squamosa*, Linn., is now to be found naturalized over large areas, especially in the drier parts of India. *A. reticulata*, Linn.; Vern. *Ramphal*, *louná*, Hind.; *Nóna*, Beng.; *Góm*, Sonthal; *Rámsita*, Tam.; *Ramasita palam*, Tel.; *Awza*, Burm., is the "Bullock's Heart." *A. Cherimolia*, Miller, is an American species occasionally found in cultivation.

1. **A. squamosa,** Linn.; Fl. Ind. i. 78; Roxb. Fl. Ind. ii. 657; Brandis For. Fl. 6; Kurz For. Fl. i. 46; Bedd. Fl. Sylv. ix.; Gamble Darj. List 3; Talbot Bomb. List 5. The Custard Apple. Vern. *Sharifa*, *sitaphal*, Hind.; *Ata*, *lúna*, Beng.; *Ata*, *katúl*, Ass.; *Mandar góm*, Sonthal; *Sirpha*, *atta*, Mal.; *Sita*, Tam.; *Sita pandu*, Tel.; *Atta*, Cingh.; *Awza*, Burm.

A small tree. *Bark* thin, grey. *Wood* soft, close-grained, greyish-white, with numerous firm, clear, wavy cross-bars. *Pores* moderate-

sized, scanty, subdivided or in short radial lines. *Medullary rays* moderate-sized.

Introduced from the West Indies, and now naturalized.

The Custard Apple is cultivated for its fruit almost all over India. It is very common in a wild state near old forts in the Deccan country, as may be seen at such places as Gooty and Penukonda in Anantapur, Guramkonda and Gandikota in Cuddapah, Kondavid, Kondapalle and Bellamkonda in Kistna District, in Madras; also, according to Brandis, in the Central Provinces and Bandelkhand. General Cunningham, quoted by Watt (Dict., vol. i. p. 259), having discovered carved representations of the fruit and leaves on the Bhârhut Stupa, believed the tree to be indigenous; but Watt himself disagrees with this view. Dr. Royle says the seeds are often powdered and mixed with grain flour and used to kill insects in the hair (R. N. Brown's Handbook).

		lbs.
B 2317.	Myanaung, Burma (Gamble)	46
D 4318.	Kondavid Fort, Kistna, Madras (Gamble).	

The wood of *Anona muricata*, Linn., the "Soursop," which is occasionally found in cultivation in India, has a similar structure (Nordlinger's Sections, vol. 4).

TRIBE V. MILIUSEÆ.

18. PHÆANTHUS, Hook. f. and Th.; *P. andamanicus*, King Ann. Calc. iv. 153, is a small shrub of the South Andaman Island. *P. malabaricus*, Bedd.; Fl. Br. Ind. i. 72; King Ann. Calc. iv. 154, is a small tree of the Wynaad forests in Malabar.

19. MILIUSA, Lesch.

This genus contains seven Indian species, one of which, *M. velutina*, is remarkable for being one of the few plants in the Order to extend to Northern India. *M. macrocarpa*, Hook. f. and Th.; Fl. Br. Ind. i. 86; Gamble Darj. List 4; King Ann. Calc. iv. 155, is a small tree of the Sikkim Himalaya and Khasia Hills, at about 3-5000 ft., "common in the Tukdah Reserve" (Gamble, *loc. cit.*). *M. Wightiana*, Hook. f. and Th.; Fl. Br. Ind. i. 87; Bedd. Fl. Sylv. x.; King Ann. Calc. iv. 156, is a small tree of the hills of Travancore and Tinnevelly; and *M. nilagirica*, Bedd. is a large shrub of the Nilgiris at about 5000 ft. In Ceylon, *M. zeylanica*, Gardn. is an endemic shrub; and *M. indica*, Lesch.; Fl. Br. Ind. i. 86, a shrub which also extends to Malabar and Mysore, as well as to Kanara and the Konkan (Talbot Bomb. List 5).

1. **M. Roxburghiana,** Hook. f. and Th.; Fl. Br. Ind. i. 87; Kurz For. Fl. i. 47; Gamble Darj. List 4; King Ann. Calc. iv. 155. *Uvaria dioica*, Roxb. Fl. Ind. ii. 659. Vern. *Sungden*, Lepcha; *Tusbi*, Sylhet.

A small tree. *Bark* thin, grey to greyish-brown, with small vertical lenticels. *Wood* greyish-white, hard; cross-bars numerous, white, wavy. *Pores* very small, scanty. *Medullary rays* short, white, of all sizes from fine to broad, very numerous; the silver-grain marked like "bird's-eye" maple.

Terai and valleys of the Sikkim Himalaya up to 2000 ft.; Assam, Chittagong, and Burma.

		lbs.
E 2316.	Chunbati, Darjeeling, 2000 ft. (Gamble)	51

2. **M. velutina,** Hook. f. and Th.; Fl. Br. Ind. i. 87; Bedd. Fl. Sylv. t. 37; Brandis For. Fl. 6; Kurz For. Fl. i. 47; King Ann. Calc. iv. 158. *Uvaria villosa*, Roxb. Fl. Ind. ii. 664. Vern. *Dom-sál*, Hind.; *Daulo*, Kumaon; *Gausal*, Garhwal; *Kari*, C.P.; *Kharrei*, *kajrauta*, Oudh; *Karikaput*, Koderma; *Peddachilka dúdúga*, *nalla dúdúga*, Tel.; *Thabutkyi*, Burm.

A deciduous moderate-sized tree, with a short erect trunk; in Burma a large tree. *Bark* ½ inch thick, rough. *Wood* yellow when fresh cut, grey or greyish-brown when dry, moderately hard; cross

bars distinct, numerous, about 100 per inch. *Annual rings* indistinct. *Pores* small, uniformly distributed, often in short radial lines, rather scanty. *Medullary rays* fine and moderately broad, the distance between two rays larger than the transverse diameter of the pores; silver-grain good.

Forests of the sub-Himalayan tract from the Jumna eastwards to Nepal, common in Dehra Dún; Oudh, Central Provinces, Orissa, Northern Circars, Burma.

A fine tree with large soft leaves. The wood is easily worked and durable, but rather liable to warp; it is used for carts and agricultural implements, spear-shafts and oars. Brandis gives the weight as 40 to 50 lbs., Kurz as 42 lbs., Beddome as 50 lbs., Benson's experiments give 60 and Skinner's (No. 93) 50 lbs. Benson gives P = 833, and Skinner P = 839. Bourdillon says, Weight 50 lbs., P = 847, but his specimens are from Travancore, where the tree is apparently not indigenous. The leaves are apparently not eaten by either cattle or goats. The tree is frequently found associated with Sál.

		lbs.
O 3113.	Dehra Dún (Bailey)	53
O 4799.	Kotri coppice, Saharanpur (Gradon)	37
B 3062.	Prome, Burma (Ribbentrop)	—
B 3122.	Burma (Brandis, 1862)	48

Nordlinger's Section, vol. 10, seems not to be from an Anonaceous wood.

20. SACCOPETALUM, Bennett.

Five species. *S. sclerocarpum*, Hook. f. and Th.; *Fl. Br. Ind.* i. 88; King Ann. Calc. iv. 160 (*Miliusa sclerocarpa*, Kurz i. 48), is a tree of the upper mixed forests of the Martaban hills and Tenasserim, having, according to Kurz, a rather heavy, fibrous but close-grained, soft, yellowish wood.

1. **S. tomentosum**, Hook. f. and Th.; Fl. Br. Ind. i. 88; Bedd. Fl. Sylv. t. 39; Brandis For. Fl. 7; Talbot Bomb. List 5; King Ann. Calc. iv. 159. *Uvaria tomentosa*, Roxb. Fl. Ind. ii. 667. Vern. *Kirua, karri*, Hind.; *Homba*, Melghat; *Hoom*, Bombay; *Wumb, hessare*, Kan.; *Chilkadúdú*, Tel.; *Toska*, Gondi; *Humba*, Kurku; *Omé*, Sonthal; *Heeran*, Mal Pahari; *Umbia, umbi*, Merwara; *Umb*, Jeypore; *Omé, haké húmú*, Kól; *Gondu palasu*, Uriya.

A large deciduous tree with straight stem. *Bark* $\frac{1}{3}$ in. thick, of various shades, sometimes black, deeply cracked. *Wood* yellow to olive-brown, moderately hard, smooth, close-grained; no heartwood; cross-bars regular, narrow, about 150 per inch. No *annual rings*. *Pores* small and moderate-sized, fairly numerous. *Medullary rays* moderately broad, numerous, showing a well-marked silver-grain.

Oudh, Nepal Terai, Gorakhpur, and southwards throughout the Peninsula.

In Oudh it is often gnarled and knotty from lopping (Brandis); the wood is used only for huts and sheds, and the leaves as cattle-fodder. Weight of wood about 40 lbs. per cubic foot.

		lbs.
O 342.	Gorakhpur (1868)	—
C 1109.	Ahiri Forest, C.P. (R. Thompson)	45
C 3471.	Saranda Forests, Chota Nagpore (Gamble)	—
D 4337.	Ballipalle Forest, Cuddapah (Gamble)	34

Nordlinger's Sections, vol. 10.

2. **S. longiflorum**, Hook. f. and Th.; Fl. Br. Ind. i. 88; King Ann. Calc. iv. 160.

A deciduous tree. *Wood* yellowish-brown, moderately hard, smooth, even-grained, with regular fine prominent cross-bars, about 150 per inch, more clearly marked than in *S. tomentosum*. *Pores* moderate-sized, scanty, much subdivided radially, sometimes into as many as four. *Medullary rays* moderately broad to broad, regular,

Purneah District of N. Bengal; Chittagong.

This tree is at present only known in cultivation in the Calcutta R. Bot. Garden, where it was introduced in 1810. Buchanan-Hamilton discovered it in Purneah, but it has not again been found either there or in Chittagong.

Nordlinger's Sections, vol. 9 (*Uvaria Badajamba*, Roxb.). (Tab. I. 2.)

21. ALPHONSEA, Hook. f. and Th. contains five species. *A. lutea*, Hook. f. and Th.; Fl. Br. Ind. i. 89; Bedd. Fl. Sylv. x.; Kurz For. Fl. i. 49; Trimen Fl. Ceyl. i. 36; King, Ann. Calc. iv. 162, is a tree of Eastern Bengal, Burma, Orissa and Ceylon. *A. ventricosa*, Hook. f. and Th.; Fl. Br. Ind. i. 89; Kurz For. Fl. i. 48; King Ann. Calc. iv. 162 (*Uvaria ventricosa*, Roxb. Fl. Ind. ii. 658); Vern. *Chooi*, And., is a tall tree of Assam, Chittagong and the Andamans, where it is used in boat-building and for native bows and squares to 30 ft. by 15 in. (Heinig). *A. madraspatana*, Bedd. Fl. Sylv. t. 76; Fl. Br. Ind. i. 89; King Ann. Calc. iv. 165, is a handsome evergreen tree of the hills of Cuddapah and N. Arcot up to 3000 ft. *A. zeylanica*, Hook. f. and Th.; Fl. Br. Ind. i. 89; Bedd. Fl. Sylv. x.; Trimen Fl. Ceyl. i. 36; King Ann. Calc. iv. 165, is a tree of the Tinnevelly and Travancore hills, and the moist low country of Ceylon. *A. sclerocarpa*, Thw. is a rare endemic Ceylon tree only known from near Haragama, on the Kandy-Badulla road.

ORDER V. MENISPERMACEÆ.

An Order which, however interesting botanically and structurally, is of very little consequence in Forest Economy. Most of the species are climbing plants, only one reaching the dimensions of a small tree. Of the 17 genera found in India, many contain only single species. These 17 genera belong to 4 Tribes, viz.:—

Tribe I. Tinosporeæ	Aspidocarya, Parabæna, Tinospora, Fibraurea, Anamirta, Coscinium.
„ II. Cocculeæ	Tiliacora, Limacia, Cocculus, Pericampylus.
„ III. Cissampelideæ . . .	Stephania, Cissampelos, Cyclea, Lophophyllum.
„ IV. Pachygoneæ	Pachygone, Pycnarrhena, Hæmatocarpus.

Wood of anomalous structure, usually with large or very large *pores* and broad or very broad *medullary rays*. The *pores* occur in a concentric series of wedges separated radially by the *medullary rays* and concentrically by a belt of tissue similar to that of the medullary rays. Sometimes, however, as in *Coscinium*, the belts are wanting. In the outer end of each wedge is often a small mass of tissue resembling that of the *pith*, which is usually large and composed of large cells.

1. ASPIDOCARYA, Hook. f. and Th. *A. uvifera*, Hook. f. and Th.; Fl. Br. Ind. i. 95; Gamble Darj. List 4; Vern. *Pangla*, Nep.; *Myungarer*, Lepcha, is a climber of the Lower Darjeeling Hills at about 1–5000 ft.

Hooker and Thomson in Fl. Ind. 180 (1855) say, "The wood of *Aspidocarya* differs 'remarkably from that of other *Menispermaceæ*, in respect of the crescent-shaped bundles 'of tissue, altogether resembling liber, which are found at the inner (? *outer*) end of 'each wood-wedge."

2. PARABÆNA, Miers. *P. sagittata*, Miers; Fl. Br. Ind. i. 96; Gamble Darj. List 4; Vern. *Karpati*, Nep., is a climbing shrub of the Eastern Himalaya, from Nepal eastwards, the Khasia Hills and Eastern Bengal down to Chittagong; also in Upper Burma.

Hooker and Thomson in Fl. Ind. 180 say the *wood* is spongy, with lax cellular tissue and radiating wood-wedges, beyond which is an outer layer of liber-like tissue.

3. TINOSPORA, Miers.

Five species, all climbers, chiefly of E. Bengal and Burma (see Kurz For. Fl. i. 52).

1. **T. cordifolia**, Miers; Fl. Br. Ind. i. 97; Brandis For. Fl. 8; Kurz For. Fl. i. 52; Gamble Darj. List 4; Talbot Bomb. List 6; Trimen Fl. Ceyl. i. 39. *Menispermum cordifolium*, Willd.; Roxb. Fl. Ind. iii. 811. Vern. *Batindu, gilo, gulel*, Pb.; *Golancha*, Beng.; *Gurcha*, Kumaon; *Gurjo*, Nep.; *Galwail, gulaveli, giroli, gulo*, Mar.; *Gúrúj*, Monghyr; *Chintil*, Tam.; *Tippa tiga*, Tel.; *Rasa-kinda*, Cingh.

A glabrous, succulent, climbing shrub, often reaching a great height and sending down long thread-like aërial roots. *Bark* grey or creamy-white, deeply cleft in spiral longitudinal clefts, the space between the clefts usually dotted with large rosette-like corky lenticels. *Wood* white, soft, porous. *Pores* small to large, rather scanty, irregularly arranged between the few broad *medullary rays*.

Throughout India, except in the colder hills.
The root is used in native medicine, chiefly as a febrifuge and tonic. Elephants are very fond of the stems, and pull them down off the trees to eat.

D 3968. Sandúr, Bellary (Gamble).
O 4825. Thano forest, Dehra Dún (Gleadow).

4. FIBRAUREA, Lour. *F. tinctoria*, Lour.; Fl. Br. Ind. i. 98; Kurz For. Fl. i. 53, is a lofty climbing glabrous shrub of Tenasserim.
According to Hooker and Thomson, Fl. Ind. 204, the *wood* is firm, consisting of narrow wedges separated by narrow dense *medullary rays*. *Pith* loose. *Bark* papery.

5. ANAMIRTA, Colebr. *A. Cocculus*, W. and A.; Fl. Br. Ind. i. 98; Brandis For. Fl. 8; Kurz For. Fl. i. 53; Talbot Bomb. List 7 (*Menispermum Cocculus*, Roxb. Fl. Ind. iii. 807. *Anamirta paniculata*, Trimen Fl. Ceyl. i. 40); Vern. *Kakmári*, Hind.; *Karwi*, Mar.; *Titta-wel*, Cingh., is a climbing shrub of Oudh, E. Bengal, South India, Ceylon and Burma, with bitter berries, which in India are used to poison fish and crows, and in Europe under the name "Cocculus indicus" to adulterate beer (Hook. f. and Th.).

6. COSCINIUM, Colebr.

1. **C. fenestratum**, Colebr.; Fl. Br. Ind. i. 99; Trimen Fl. Ceyl. i. 41. *Menispermum fenestratum*, Gaertn.; Roxb. Fl. Ind. iii. 809. Vern. *Weni-wel*, Cingh.

A woody climber. *Bark* yellowish-brown, corky, ⅓ in. thick. *Wood* bright yellow, porous, soft, pith large. *Pores* of all sizes, chiefly very large. *Medullary rays* extremely broad, gradually increasing in size outwards.

Moist low country of Ceylon; perhaps also in S. India.
The wood is used as a bitter tonic by the Cinghalese, and has been exported as a substitute for Calumba root (*Jateorhiza palmata*, Miers). It is also used to give a yellow dye (Trimen). Roxburgh quotes a letter from General Macdowall which says that the stems are strong and are used for ropes to tie cattle, etc.

Ceylon—Kew Museum (Thwaites).
Nordlinger's Sections, vol. 4 (*Menispermum fenestratum*).

7. TILIACORA, Colebr.

1. **T. racemosa**, Colebr.; Fl. Br. Ind. i. 99; Brandis For. Fl. 10; Kurz For. Fl. i. 54; Talbot Bomb. List 7; Trimen Fl. Ceyl. i. 42. *Menispermum polycarpon*, Roxb. Fl. Ind. iii. 816. Vern. *Tiliakoru*, Beng.; *Karwanth, rangoe*, Hind.; *Tiga mushadi*, Tel.

A large climbing shrub. *Bark* light brown, smooth. *Wood* greyish-brown, soft, porous, in oblong radial wedges arranged concentrically

in a ring which alternates with rings of liber-like consistence. *Pores* moderate-sized to large. *Medullary rays* very broad.

Throughout India, Burma, and Ceylon, chiefly affecting hedges and bushy clumps in open land, but often again climbing high over forest trees.

The long branches are used for thatching and basketwork (Brandis). The root is used as a cure for snake-bite (Roxb.).

D 3755. Tamminapatam, Nellore (Gamble).

8. LIMACIA, Lour. Three climbing shrubs of little importance found in Eastern Bengal and Burma, one also in Ceylon, *L. cuspidata*, Hook. f. and Th.; Fl. Br. Ind. i. 100; Kurz For. Fl. i. 54; Trimen Fl. Ceyl. i. 42, t. 4; Vern. *Niri-wel*, Cingh., common in the low country up to 4000 ft.

9. COCCULUS, DC.

Five species of straggling or climbing shrubs, one of which runs to the dimensions of a small tree. *C. villosus*, DC; Fl. Br. Ind. i. 101; Brandis For. Fl. 9; Talbot Bomb. List 7; Trimen Fl. Ceyl. i. 44. (*Menispermum hirsutum*, L.; Roxb. Fl. Ind. iii. 814); Vern. *Karsane*, Oudh; *Kursan, zamir*, Sind; *Vasanvel*, Mar., is a straggling, scarcely woody, but very bushy climber common in most parts of India. *C. mollis*, Wall. is a climber of Nepal and the Khasia Hills.

Wood in wedges containing *pores*, and at the end of each a small mass of pith-like tissue. The wedges are separated radially by the *medullary rays*, and concentrically by belts of tissue of similar structure to that of the rays.

1. **C. macrocarpus**, W. and A.; Fl. Br. Ind. i. 101; Talbot Bomb. List 7; Trimen Fl. Ceyl. i. 43. *C. glaucescens*, Bl.; Kurz For. Fl. i. 55. Vern. *Vatoli, vatyel*, Mar.

A large woody climber. *Bark* thin, grey. *Wood* soft, dark grey, with large pores and broad *medullary rays* which join broad concentric bands of similar tissue.

West and South India, Ceylon, and Burma.

W 3933. Coonoor Ghát, Nilgiris, 3000 ft. (Gamble).
Chittagong—Kew Museum (J. D. Hooker).

2. **C. laurifolius**, DC; Fl. Br. Ind. i. 101; Brandis For. Fl. 9; Bedd. Fl. Sylv. xii. *Menispermum laurifolium*, Roxb. Fl. Ind. iii. 815. Vern. *Tilpara, kakra*, Hind.; *Padma-golancha*, Beng.

A small or moderate-sized bushy evergreen tree. *Bark* very thin, dark grey. *Wood* greyish-white, soft to moderately hard, with belts of tissue containing pores in narrow wedges alternating with narrow more or less concentric but anastomozing bands of texture resembling that of the medullary rays. *Pores* small and moderate-sized, scanty. *Medullary rays* broad and very broad, forming a marked satiny silver-grain. The medullary rays in one belt are not always continued in the next, but sometimes are divided up into several.

Outer Himalaya from the Ravi to Nepal ascending to 5000 ft.; higher ranges of the Anamalais in S. India from 5–7000 ft.; Shan Hills in Burma.

A handsome plant with beautiful glossy leaves and a very interesting wood. The concentric rings are not regular, but anastomoze, like the similar rings in the wood of some *Capparideæ* and *Avicennia*. The leaves are not eaten by goats. It is sometimes planted in gardens, and has been introduced into South Europe.

		lbs.
H 2939.	Suni, Sutlej Valley, 3000 ft. (Gamble)	42
E 2466.	Calcutta, R. Botanic Garden (King)	40

		lbs.
O 4497.	Malkot Forests, Dehra Dún, 4000 ft. (Gamble) . . .	40
O 4643.	Forest School Garden, Dehra Dún (Babu Birbal) . . .	36

3. C. Leæba, DC; Fl. Br. Ind. i. 102; Brandis For. Fl. 9; Talbot Bomb. List 7. Vern. *Vallur, illar, billar,* Punjab; *Pilwari bél,* Jeypur.

A climbing shrub, stem often reaching 3 to 4 ft. in girth. *Bark* pale yellowish-brown, corky, thick, deeply cleft vertically. *Wood* structure very similar to that of *C. laurifolius*, but the *pores* much larger, and larger pith masses at the end of each wedge.

Dry and arid regions of India: Punjab, Baluchistan, Sind, Deccan.
Sind—Kew Museum (N. A. Dalzell, 1860).
Nordlinger's Sections, vol. 5.

10. PERICAMPYLUS, Miers. *P. incanus*, Miers; Fl. Br. Ind. i. 102 (*Menispermum villosum*, Roxb. Fl. Ind. iii. 812), is a climbing shrub of Northern and Eastern Bengal and Burma.

Hooker and Thomson in Fl. Ind. 194 (1855) describe the stem as cylindrical and groved, the *wood* as in wedges separated by broad medullary rays.

11. STEPHANIA, Lour.

Three species. *S. hermandifolia*, Walp.; Fl. Br. Ind. i. 103; Talbot Bomb. List 8; Trimen Fl. Ceyl. i. 45 (*Cissampelos hernandifolia*, Willd.; Roxb. Fl. Ind. iii. 842); Vern. *Lunuketiya wel*, Cingh.; *Thanaze*, Burm., is a climbing shrub of Northern and Eastern Bengal, South India and Ceylon. In the Nilgiris it is often met with of considerable size. *S. elegans*, Hook. f. and Th., is a small species chiefly of the Central and Eastern Himalaya, at 6–7000 ft.

1. S. rotunda, Lour.: Fl. Br. Ind. i. 103; Brandis For. Fl. 571; Gamble Darj. List 4 (*Cissampelos glabra*, Roxb. Fl. Ind. iii. 840). Vern. *Nimi*, Nep.; *Gajera, garjial*, Kumaon; *Parha*, Dehra Dún.

A tuberous-rooted, large climbing shrub. *Wood* soft, spongy, with large loose *pith* arranged in wedges, separated by broad *medullary rays*, and concentrically by a belt of soft similar tissue. *Pores* large (*after Hooker and Thomson, Fl. Ind.* 195).

Almost throughout India.
The bark gives a fibre sometimes used for fishing-lines.

12. CISSAMPELOS, Linn.

1. C. Pareira, Linn.; Fl. Br. Ind. i. 103; Brandis For. Fl. 10; Gamble Darj. List 4; Talbot Bomb. List 8; Trimen Fl. Ceyl. 46. *C. convolvulacea*, Roxb. Fl. Ind. iii. 842. Vern. *Katori, parbik, pataki, tikri*, Pb.; *Dakh nirbisi, purhé, pári*, N.-W.P.; *Gajuro*, Kumaon; *Parai*, Garhwal; *Harjeuri*, Oudh; *Batúlpati*, Nep.; *Pata*, Tel.; *Paharvel, paharmul*, Mar.; *Diya-mitta*, Cingh.

A small climber. *Wood* brown, divided by very broad *medullary rays* and regular concentric bands of similar texture into small rectangular divisions, each with from two to eight small to very large *pores*, as in *Cocculus*, but more distant.

Throughout India and Ceylon, very common.
The leaves and root are used medicinally, and were said to give the "Radix pareiræ" of druggists; but this has lately been disproved by Hanbury. It gives a strong fibre.
Nordlinger's Sections, vol. 8.
A specimen of the wood of this climber, sent from South America by D. Hanbury, is in the Kew Museum. It shows radiating ovate patches of fibro-vascular tissue,

arranged star-fashion and separated by medullary-ray tissue both radially and concentrically; the pores in the patches more numerous than in Nordlinger's specimen.

13. CYCLEA, Arnott. Two species: small climbing shrubs. *C. Burmanni*, Miers; Fl. Br. Ind. i. 104; Talbot Bomb. List 8; Trimen Fl. Ceyl. i. 47; Vern. *Pakur*. Mar.; *Kehi-pittan, kesi-pissan*, Cingh., is found on the Western Coast and in Ceylon. *C. peltata*, Hook. f. and Th.; Fl. Br. Ind. i. 104; Talbot Bomb. List 8; Vern. *Paryel*, Mar., is found in Assam, Eastern Bengal, and Western and Southern India. *Wood* in linear-clavate wedges, separated by broad medullary rays (Hook. and Thomson, 201).

14. LOPHOPHYLLUM, Griffith. *L. bicristatum*, Grift.; Fl. Br. Ind. i. 105, is a tall climber of the Sikkim and Bhutan Himalaya and Khasia Hills, with white bark.

15. PACHYGONE, Miers. *P. ovata*, Miers; Fl. Br. Ind. i. 105; Trimen Fl. Ceyl. i. 45; Vern. *Kaddukkodi*, Tam., is a small woody climber of the Carnatic coast and Ceylon.

16. PYCNARRHENA, Miers. *P. pleniflora*, Miers; Fl. Br. Ind. i. 106, is a suberect or climbing shrub of Sylhet.

17. HÆMATOCARPUS, Miers. *H. Thomsoni*, Miers; Fl. Br. Ind. i. 106, is a large climber of the North-East Himalaya and Khasia Hills.

ORDER VI. BERBERIDEÆ.

An Order of shrubby plants, erect or climbing, found in temperate regions of the Northern Hemisphere, in India in hill regions only. It has two Tribes, with four Genera, viz.—

Tribe I. Lardizabaleæ	Decaisnea, Parvatia, Hollböllia.
„ II. Berbereæ	Berberis.

Podophyllum Emodi, Wall.; Vern. *Rikhpeta*, Jaunsar, is a herbaceous plant found in the undergrowth of Himalayan forests of oak, fir and deodar. It has usually two somewhat fleshy leaves, a large white flower and big red fruit. The root gives a kind of "podophyllin" which can be used as a medicine, much as is that of the real source of the drug, *P. peltatum*. L., of N. America.

1. DECAISNEA, Hook. f. and Th.

It may be interesting to note the recent discovery of a second species of this genus in *D. Fargesii*, Franchet, found in the provinces of Yunan and Szechuen in China.

1. **D. insignis**, Hook. f. and Th.; Fl. Br. Ind. i. 107; Hook. f. Ill. Him. Pl. t. 10; Gamble Darj. List 4. Vern. *Nomorchi*, Lepcha; *Loodooma*, Bhutia.

An erect shrub or small tree. *Bark* brown, moderately thick, smooth, with shallow vertical clefts. *Wood* hard, yellowish-white. *Pores* small, often in pairs or threes, scanty, usually radially arranged. *Annual rings* marked by a nearly continuous line of pores. *Medullary rays* moderately broad to broad, very short, somewhat lenticular in cross-section; silver-grain well marked, with rather broad plates.

Sikkim and Bhutan Himalaya, in inner ranges at 6–10,000 ft.
The fruit is edible. It is of a pale yellow colour, with a white juicy pulp.
Sikkim—Kew Museum (J. D. Hooker).

2. PARVATIA, Decaisne. *P. Brunoniana*, Dec.; Fl. Br. Ind. i. 108, is a climbing shrub of Assam and the Khasia Hills.

3. HOLLBÖLLIA, Wall.

1. **H. latifolia**, Wall. Tent. Fl. Nep. 24, t. 16; Fl. Br. Ind. i. 108; Brandis For Fl. 13; Gamble Darj. List 4. Vern. *Jangli sharifa*, Garhw.; *Gophla*, Kumaon *Chiriyanaugri, gooplea, baegúl*, Nep.; *Proncharik*, Lepcha; *Domhyem*, Bhutia.

A climbing shrub. *Bark* soft, corky. *Wood* soft, porous. *Pores* large. *Medullary rays* broad.

Himalaya from Simla to Bhutan, at elevations above 7000 ft. in North-West and 4000 ft. in North-East.

Fruit red, edible, but not so good as that of *Decaisnea*, being mealy and insipid. Vern. *Kolepot*, Lepcha (Hook. f. in Ill. Him. Pl.).

This species and its variety, *H. angustifolia*, Wall., *l.c.* t. 17, are said by Wallich to grow sometimes to a gigantic size; he also says that he procured for the East India Company's Museum portions of a trunk "as thick as a good-sized arm."

E 2859. Tukdah, Darjeeling, 5000 ft. (Gamble).

4. BERBERIS, Linn.

About thirteen species, but some of them are only quite small shrubs of the inner Himalaya. I am of opinion that one or two of the shrubs which are placed as varieties under *B. vulgaris* in the Fl. Br. Ind. deserve to be admitted as species, as they seem to be very constant in character and to affect a different climate and situation. The exceedingly well-marked plant which in Man. Ind. Timbers, 1881, was given as *B. coriacea*, Brandis, appears to be *B. coriaria*, Royle, which, in the Fl. Br. Ind., is placed under *B. aristata*: it is certainly quite distinct from that species, and is here given separately from it. It has glaucous purple fruit. *B. umbellata*, Wall.; Fl. Br. Ind. i. 110, is a shrub of the Himalaya from the Sutlej to Bhutan, found at 9-11,000 ft., with pale flowers in umbels. *B. Wallichiana*, DC; Fl. Br. Ind. i. 110, is found in the Central and Eastern Himalaya at 8-10,000 ft. and in the Khasia and Shan Hills at 5-6000 ft. *B. insignis*, Hook. f. and Th.; Fl. Br. Ind. i. 111; Gamble Darj. List 5; Vern. *Timburjhien*, Lepcha, is a large species of the Sikkim and Bhutan Himalaya at 8-10,000 ft. *B. concinna*, Hook. f.; Fl. Br. Ind. i. 111; Gamble Darj. List 5; Vern. *Tsema*, Bhutia; *Sinsur*, Lepcha, is also a shrub of the Sikkim mountains at 10-13,000 ft., with reddish branches and leaves, and is characterized by Hooker and Thomson as the most beautiful of all species for its size. *B. macrosepala*, Hook. f. also occurs in the same region. *B. ulicina*, Hook. f. and Th. is found in the inner North-West Himalaya at 14-16,000 ft., and is very thorny.

All the Barberries are handsome shrubs, and worthy of cultivation equally with the American species, the best known of which are *B. aquifolium*, L. and *B. Darwinii*, Hook. Most of them have a pleasant edible fruit. The extract from the wood and bark of almost all the species (*Rusót*) is a tonic and febrifuge, and the drug is usually obtainable in Indian bazars. A yellow dye obtained from the root and wood is sometimes used in tanning and colouring leather, and is perhaps one of the best tanning dyes in India (Watt).

The Himalayan Barberries, like the European species, are subject to the attacks of the wheat-rust, *Puccinia graminis*, Pers., which on the Barberry has its æcidial stage in the form of small cups with bright orange spores.

Wood yellow, bright when fresh cut, afterwards darkening, hard or moderately hard, splits in seasoning. *Annual rings* well marked. *Pores* small, larger and more numerous on the inner edge of each annual ring; in the rest of the wood small and in irregular short tails of loose pale tissue. *Medullary rays* bright yellow, moderately broad or broad, giving a marked silver-grain.

1. B. nepalensis, Spreng.; Fl. Br. Ind. i. 109; Bedd. Fl. Sylv. xi.; Brandis For. Fl. 12; Kurz For. Fl. i. 58; Gamble Darj. List 5. *B. pinnata*, Roxb. Fl. Ind. ii. 184 (probably). Vern. *Amúdanda, chiror*, Pb.; *Kamal, kamla*, Ravi; *Pande kilmora, chotara, chotra*, Kumaon; *Khora*, Jaunsar; *Chatri, milkisse, jamnemúnda*, Nep.; *Kyarbo*, Lepcha; *Jakkahi*, Nilg.; *Maranthu*, Trav. Hills.

An evergreen pinnate-leaved shrub or small erect tree. *Bark* light brown, soft, corky. *Wood* bright yellow, darkening after exposure, hard. *Pores* very small, arranged in radial lines or patches, those of the annual rings larger. *Medullary rays* moderately broad,

prominent, numerous; well marked on a radial section as a pretty silver-grain.

Outer Himalaya from the Ravi to Bhutan; Khasia Hills; Shan Hills of Burma, Tenasserim; Nilgiris and other hills of S. India above 5000 ft.

An ornamental species well known in European gardens. The wood weighs about 45 lbs. per cubic foot. In the Travancore Hills, the bark is considered a remedy for snakebite (Bourdillon).

		lbs.
H 4815.	Chakrata, Jaunsar, 7000 ft. (Gamble)	43
E 2318.	Darjeeling, 7000 ft. (Gamble)	49
W 3913, 3996, 4098.	Nilgiri Hills, 7000 ft. (Gamble)	44, 45, 46

2. **B. vulgaris**, Linn.; Fl. Br. Ind. i. 109; Brandis For. Fl. 11. The Barberry. *Épine-Vinette*, Fr.; *Sauerdorn*, Germ.; *Crespino*, Ital. Vern. *Zirishk*, *kashmal*, *chochar*, *tutrúm*, *kembal*, Pb.; *Chatroá*, Jaunsar.

A deciduous thorny shrub. *Bark* soft, brown, ⅛ in. thick. *Wood* lemon-yellow, moderately hard, even-grained. *Annual rings* marked by an irregular belt of small pores, which are larger than those in the rest of the wood. *Pores* in the main portion of the annual rings grouped in short, whitish, irregularly bent lines or tails. *Medullary rays* fine to moderately broad, distant; well marked in silver-grain.

Himalaya, from Nepal westwards, in shady forests above 8000 ft. elevation; Afghanistan and Baluchistan, Europe.

Weight: specimen examined gives 55 lbs. per cubic foot; Mathieu Fl. For. p. 12, gives 45 to 57 lbs. Fruit edible. The wood is a good firewood.

		lbs.
H 3037.	Matiyana, Simla, 9000 ft. (Gamble)	—
H 3040.	Nagkanda, Simla, 9000 ft. „	55
	Nordlinger's Sections, vol. 2.	

3. **B. aristata**, DC; Fl. Br. Ind. i. 110; Bedd. Fl. Sylv. xii.; Brandis For. Fl. 12; Gamble Darj. List 5; Trimen Fl. Ceyl. i. 48. *B. angustifolia*, Roxb. Fl. Ind. ii. 183. Vern. *Súmlú*, *simlu*, *kasmal*, *chitra*, *kashmi*, *tutrúm*, *kúlsú*, Pb.; *Tsema*, Bhutia; *Chitra*, *matékisse*, Nep.; *Chotra*, Hind.; *Kashmoi*, Jaunsar; *Kingora*, Garhwal; *Kilmora*, *chathur*, Kumaon; *Sumbul*, Kashmir.

An erect spinous shrub. *Bark* soft, light brown, corky. *Wood* bright yellow, hard. *Annual rings* distinctly marked by a narrow belt of numerous pores. *Pores* small, in short, narrow, wavy tails of light-coloured tissue. *Medullary rays* moderately broad, regular, making a pretty silver-grain.

Outer Himalaya from the Sutlej to Bhutan; in the North-West Himalaya, 6–10,000 ft.; in Darjeeling, above 10,000 ft.; Western Ghâts at high elevations; Ceylon.

Wood used for fuel, the root in native medicine. Growth 12 to 15 rings per inch.

		lbs.
H 80.	Simla, 7000 ft.	52
H 2888.	Nagkanda, Simla, 8000 ft. (Gamble)	—
H 3053.	Mahasu, Simla, 8000 ft. „	—
H 4420.	Jaunsar, North-West Himalaya (Gamble)	51
W 3741.	Coonoor, Nilgiris, 6000 ft. „	—
W 3928.	Avalanché, Nilgiris, 7000 ft. „	—
W 4039.	Cairn Hill, Nilgiris, 7000 ft. „	51

4. **B. coriaria**, Royle. *B. aristata*, var. *floribunda*, Fl. Br. Ind. i. 110. *B. coriacea*, Brandis; Man. Ind. Timbers, 1st ed. 14. Vern. *Kashmal*, Simla; *Kashmoi*, Jaunsar; *Kingora*, Garhwal.

A large erect thorny shrub. *Bark* soft, corky. *Wood* yellow, paler than in the other species, moderately hard. *Annual rings* marked

by a belt of small or moderate-sized pores; in the rest of the wood the *pores* are very small or extremely small, and arranged in numerous confluent, irregularly shaped tails and patches of whitish tissue. *Medullary rays* short, fine to broad, giving a pretty silver-grain.

Western Himalaya above 8000 ft.; often forming alone or with other shrubs large extents of scrub jungle, *e.g.* in the valley south of Nagkanda near Simla, and in some places in Jaunsar.

		lbs.
H 48.	Nagkanda, Simla, 9000 ft.	—
H 2894, 3039, 3041, 3043.	Nagkanda, Simla, 9000 ft. (Gamble)	55, 52.
H 3038.	Matiyana, Simla, 8000 ft. (Gamble)	—
H 3042.	Hattu, Simla, 10,000 ft. "	—
H 4453.	Bodyar, Jaunsar, 8000 ft. "	56
H 4776.	Deota, Tehri-Garhwal, 9000 ft. (Gamble)	56

5. **B. Lycium,** Royle; Fl. Br. Ind. i. 110; Brandis For. Fl. 12. Vern. *Kasmal*, Simla; *Kashmal*, *chotra*, Hind.; *Chatroi*, Jaunsar; *Kirmora*, Garhwal.

An erect rigid shrub. *Bark* rough, corky, white or light grey. *Wood* yellow, moderately hard. *Annual rings* marked by a narrow porous belt. *Pores* very small and extremely small, in narrow irregular lines of white tissue. *Medullary rays* moderately broad, numerous, giving a marked silver-grain.

Western Himalaya, 3–6000 ft., usually on dry hot slopes; Baluchistan.
This species is recognized by its small glaucous leaves.

		lbs.
H 45.	Simla, 6500 ft.	—
H 3054.	Mahasu, Simla, 7500 ft. (Gamble).	52
H 4810.	Jaunsar, 6000 ft. "	54
P 4485.	Baluchistan (Lace).	—

6. **B. asiatica,** Roxb. Fl. Ind. ii. 182; Fl. Br. Ind. i. 110; Brandis For. Fl. 12. Vern. *Kingora*, Garhwal; *Kilmora*, Kumaon.

An erect thorny shrub. *Bark* soft, light brown, yellow in bast layers, corky outside, and deeply cleft vertically. *Wood* yellow, hard. *Annual rings* fairly distinctly marked by a narrow belt of large pores. *Pores* usually small, in small oblique patches of pale tissue. *Medullary rays* moderately broad, regular, showing a pretty silver-grain.

Dry outer Himalaya at 3–6000 ft., from Garhwal (Jumna R.) to Bhutan; Parasnáth Hill in Behar; Afghanistan.
Easily recognized by its markedly net-veined leaves.

		lbs.
O 4456.	Malkot Hills, Dehra Dún, 4000 ft. (Gamble)	56

7. **B. angulosa,** Wall.; Fl. Br. Ind. i. 111; Gamble Darj. List 5. Vern. *Chutra*, Nep.

A large erect shrub. *Bark* soft, brown, corky. *Wood* dark grey or yellowish-brown, hard. *Annual rings* marked by a belt of small pores; in the rest of the wood the *pores* are very small, arranged in irregular radial tails of whitish tissue. *Medullary rays* fine, numerous.

Inner ranges of Nepal and Sikkim above 11,000 ft.

E 2862. Suburkum, Darjeeling, 11,000 ft. (Gamble).

ORDER VII. CAPPARIDEÆ.

An Order of small trees, shrubs, herbs or climbers, the woody plants of which all come into the Tribe *Cappareæ*—Genera Niebuhria, Mærua, Cratæva, Cadaba, Boscia, Capparis and Roydsia. Some of the species are important sylviculturally from their growing in the driest regions where the number of woody plants is small; otherwise they are of but little forest importance.

Wood white or yellowish-white, moderately hard or hard. In *Cratæva* and *Capparis* the wood is homogeneous, of normal type; the *pores* small to moderate-sized, rarely large, and usually arranged in radial lines; the *medullary rays* moderately broad, wavy. In *Niebuhria*, *Mærua*, and *Cadaba trifoliata*, the structure resembles that of some MENISPERMACEÆ, such as *Cocculus*, also *Avicennia* in VERBENACEÆ, *Dalbergia paniculata* and *Derris* in LEGUMINOSÆ; the wood being divided into more or less concentric rings by belts of liber-like tissue which occasionally anastomoze—the wood belts containing small or moderate-sized *pores* and moderately broad *medullary rays*.

The main character useful in determination is that of pores in radial lines, not between each pair of medullary rays, but at intervals, pairs without pores coming between those that contain pores.

1. NIEBUHRIA, DC.

Two species. *N. siamensis*, Kurz For. Fl. i. 59, is an evergreen small tree of the Radbooree province of Siam adjoining Burma, where it may also occur.

1. **N. linearis**, DC; Fl. Br. Ind. i. 171.

A small tree. *Bark* brown, thin, granular. *Wood* white, moderately hard, divided by narrow, concentric, free but occasionally anastomozing rings of liber tissue into concentric layers. *Pores* small, scanty, in radial strings of from 2 to 12 between pairs of *medullary rays*, these rays being usually separated by 2 to 5 rays free from pores. Rays fine, numerous, wavy.

Hilly parts of the Carnatic.

	lbs.
D 4163. Venkatayapalem Forest, Kistna (Gamble)	48

2. MÆRUA, Forskahl.

1. **M. arenaria**, Hook. f. and Th.; Fl. Br. Ind. i. 171; Talbot Bomb. List 9; Trimen Fl. Ceyl. i. 58. *Capparis heteroclita*, Roxb. Fl. Ind. ii. 570. Vern. *Putta-tiga*, Tel.

A large climbing shrub. *Bark* yellow, thin, reticulated. *Wood* white, divided, like that of *Niebuhria*, into layers by narrow concentric bands of liber tissue, which occasionally anastomoze. *Pores* small, scanty, radially disposed between the fine regular *medullary rays*, but with usually one or more rays without pores between each pair that has them.

Western Himalaya; Gangetic plain, about Agra and Delhi; Central India and Carnatic; throughout Bombay Presidency; Ceylon.

D 4155. Konanki Forest, Kistna (Gamble).

3. CRATÆVA, Linn.

Three species. *C. hygrophila*, Kurz For. Fl. i. 67; Vern. *Yekadat*, Burm., is a shrub of the swamp forests of the Irrawaddy delta. *C. lophosperma*, Kurz Journ. Bot. xii. (1874) 195, is found in Assam and the Shan Hills.

1. C. religiosa, Forst.; Fl. Br. Ind. i. 172; Brandis For. Fl. 16; Bedd. Fl. Sylv. t. 116; Gamble Darj. List 5; Talbot Bomb. List 9. *C. Nurvala*, Ham.; Bedd. Fl. Sylv. xiv. *C. Roxburghii*, Br.; Kurz For. Fl. i. 66; Trimen Fl. Ceyl. i. 59. *Capparis trifoliata*, Roxb. Fl. Ind. ii. 571. Vern. *Brarua, barna, bilási, bila, biliana*, Hind.; *Barún, tikto-shak*, Beng.; *Barnál*, Melghát; *Varana, barana*, Jeypore; *Purbong*, Lepcha; *Tailadu, bunboronda*, Mechi; *Maralingam, marvilinga, navala*, Tam.; *Uskia, usiki, ulimidi, urumatti, tella voolemara*, Tel.; *Nirvála*, Kan., Mal.; *Bitúsi*, Kan.; *Kúmla, karwan*, Mar.; *Nirujani*, Coorg; *Kadat, kadat*, Burm.; *Lunu-warana*, Cingh.

A moderate-sized deciduous tree. *Bark* grey, ½ inch thick, with long horizontal wrinkles. *Wood* yellowish-white, when old turning light brown, moderately hard, even-grained. *Pores* moderate-sized, numerous and uniformly distributed, often subdivided, each pore surrounded by a whitish ring. *Medullary rays* short, very wavy, fine and moderately broad, the distance between the rays slightly greater than the transverse diameter of the pores.

Throughout India, Burma and Ceylon from the Punjab down, common in some places, rare in others. (The Fl. Br. Ind. says it is wild only in Malabar and Kanara and elsewhere cultivated, but I have seen it growing apparently wild in so many places that I think this is a mistake.)

Talbot says it is planted near Mussulman tombs; Trimen that it is planted by the Tamils in Ceylon for its bitter leaves, which are used as a stomachic; Brandis that the pulp of the fruit is mixed with mortar as a cement and is used in dyeing. The smooth wood is used for drums, models, writing-boards, combs, and in turnery, but is anything but durable and very liable to the attacks of boring beetles. Bourdillon's experiments of 1896 with Travancore wood gave P = 279, weight 28 lbs.; the specimens examined give 42 lbs., so that it would seem that his were not of very good wood.

		lbs.
P 3217.	Nagpahar, Ajmere	—
O 270.	Garhwal (1868)	33
O 3112.	Dehra Dún (Bailey)	47
C 3115.	Chanda, C.P. (Brandis)	45
B 565.	Prome, Burma (Ribbentrop)	43
Salem Collection		44

Nordlinger's Sections, vol. 10.

4. CADABA, Forskahl.

Four species. *C. heterotricha*, Stocks; Fl. Br. Ind. i. 173, is a small branched tree, 10-20 ft. high, found only on the rocks near Cape Monze in Sind by Stocks.

Wood white, soft to moderately hard, even-grained. *Pores* small, in radial strings between the fine numerous *medullary rays*, a certain number of rays without pores between them intervening between the pairs that enclose pores. In *C. trifoliata*, also in the Arabian *C. glandulosa*, Forsk. (Nordlinger's Sections, vol. 5), there are concentric but anastomozing bands of liber-like tissue separating the wood into layers as in *Niebuhria* and *Mœrua*.

1. C. trifoliata, W. and A.; Fl. Br. Ind. i. 172; Trimen Fl. Ceyl. i. 59. *Strömeria trifoliata*, Roxb. Fl. Ind. ii. 79. Vern. *Kodikallu, mallaguru, peddasiva konita*, Tel.

A large shrub or small tree. *Bark* very thin, slightly rough, brown. *Wood* white, divided by somewhat concentric, often anastomozing rings of bast tissue (as in *Niebuhria* and *Mœrua*) into layers. *Pores* small, in long radial and oblique strings broadening out towards the outer part of each layer. *Medullary rays* fine, short, rather scanty. Numerous concentric very fine and even but wavy belts of loose tissue, as in *Anonaceæ*.

Eastern Deccan and Carnatic; dry low country of Ceylon.
A very interesting wood. Flowers showy.

		lbs.
D 3991.	Ballipalle Forests, Cuddapah (Gamble)	50

2. **C. indica**, Lamk.; Fl. Br. Ind. i. 172; Talbot Bomb. List 9; Trimen Fl. Ceyl. i. 60. *Strömeria tetrandra*, Vahl; Roxb. Fl. Ind. ii. 78. Vern. *Kali taka*, Mar.; *Chemoorda*, Tel.; *Vili*, Tam.

A shrub, often straggling or half climbing. *Bark* brown, somewhat rough, with horizontal lenticels. *Wood* white, moderately hard, close-grained. *Pores* small, numerous, in long radial strings between the fine wavy *medullary rays*, usually one or two rays without pores between each string. Faint, rather distant, concentric lines which may be annual rings.

South India from Guzerat through the Konkan, Deccan and Carnatic, often on black cotton soil, sometimes on other trees or on old walls, common; dry region of Ceylon, scarce.

		lbs.
D 4053.	Dhone, Kurnool (Gamble)	—
D 4152.	Gudibanda, Kistna (Gamble)	—
D 4272.	Anantapur (Gamble)	51

3. **C. farinosa**, Forsk.; Fl. Br. Ind. i. 173; Talbot Bomb. List 9.

A straggling much-branched shrub. *Wood* white, soft, even-grained. *Pores* small, single or few or many in radial strings between the rays, there being usually a few rays without pores between each pair that contains them. *Medullary rays* very fine, regular, numerous.

Sind and about Multán in the Punjab.

Nordlinger's Sections, vol. 11.

5. BOSCIA, Lamk. *B. variabilis*, Coll. and Hemsl.; Journ. Linn. Soc. xviii. 18. (*Niebuhria variabilis*, Kurz For. Fl. i. 59); Vern. *Thamôn*, Burm. is a small tree common in the open forest tracts about Meiktila in Upper Burma.

6. CAPPARIS, Linn.

A large genus containing about 40 species, small trees, shrubs or climbers, most of them of very little importance in forest economy. *C. spinosa*, Linn.; Fl. Br. Ind. i. 173; Brandis For. Fl. 14; Talbot Bomb. List 10; the Caper; Vern. *Kabarra*, Afg.; *Kábra*, Tibet; *Kaur, keri, kandar, kakri, taker, ber, barari, bauri, bassar*, Pb.; *Kiari, bauri*, Jaunsar; *Ulta-kanta*, Kumaon; *Kalvári*, Sind, is a small shrub which grows on rocks in the Punjab, Baluchistan, Sind, N.-W. Himalaya and the hills of Guzerat as far as Mahabaleshwar; affecting the hottest localities, and very pretty with its greyish-green leaves and handsome flowers. The flower-buds are the "capers" of commerce, and are pickled and eaten in Sind and the Punjab. J. L. Stewart says that the leaves are eaten in Ladak as a vegetable; he mentions that along the Himalayan rivers the plant ascends far, *e.g.* to Wangtú (5000 ft.) on the Sutlej, to Iskardo on the Indus (10,500 ft.), and to Léh (12,000 ft.). *C. zeylanica*, L.; Fl. Br.

Ind. i. 174; Talbot Bomb. List 10; Trimen Fl. Ceyl. 61; Vern. *Wagutty*, Mar.; *Katoddi*, *veunachchi*, Tam., is a common shrub in dry regions in S. India, especially in the Circars and Carnatic, the Konkan and Kanara, and in Ceylon, with handsome flowers. *C. Heyneana*, Wall.; Fl. Br. Ind. i. 174; Talbot Bomb. List 10; Vern. *Chayruka*, Hind., is a shrub of the evergreen forests of the Western Ghâts; where also is found *C. Roxburghii*, DC; Fl. Br. Ind. i. 175; Talbot Bomb. List 10; Trimen Fl. Ceyl. i. 62; Vern. *Poorwi*, Mar.; *Punai-virandi*, Tam., which also occurs in the Carnatic and Ceylon. On the western coast and in Ceylon is also found *C. Moonii*, Wight; Fl. Br. Ind. i. 175; Talbot Bomb. List 10; Trimen Fl. Ceyl. i. 62, an ornamented shrub with large white flowers. *C. viminea*, Hook. f. and Th.; Fl. Br. Ind. i. 179; Gamble Darj. List 6; Vern. *Chiuli*, Nep.; *Pundri*, Lepcha, is a large shrub of the tropical valleys of the Eastern Himalaya, of Assam, and of the Shan hills in Burma. *C. micracantha*, DC; Fl. Br. Ind. i. 179; Kurz For. Fl. 61, is a small tree, shrub or climber (Kurz) of Burma. *C. burmanica*, Coll. and Hemsl.; Journ. Linn. Soc. xxviii. 19, t. 2, is a shrub of Upper Burma; *C. flavicans*, Wall.; Fl. Br. Ind. i. 179, is also found in the same region, in Yemethen and elsewhere; *C. glauca*, Wall.; Fl. Br. Ind. i. 180, also occurs about Pagamew (Wallich) and Meiktila (Collett); while *C. hastigera*, Hance, and *C. xanthophylla*, Coll. and Hemsl. *l.c.* 20, are found on dry plains in the same region. *C. Cathcarti*, Hemsl.; Gamble Darj. List 6; Ann. Calc. ix. 8, t. 10, is a large climbing shrub of the Darjeeling Hills at 3–4000 ft.

Wood white, hard or moderately hard, sometimes with incomplete concentric liber rings. *Pores* of various sizes, single or in radial groups, at intervals, between the rays. *Medullary rays* fine or moderately broad, short.

1. C. divaricata, Lamk.; Fl. Br. Ind. i. 174; Talbot Bomb. List 10; Trimen Fl. Ceyl. i. 61. *C. stylosa*, DC; Bedd. Fl. Sylv. xiii. Vern. *Toaratti*, Tam.; *Budareni*, Tel.; *Pachûnda*, Mar.

A small tree. *Bark* very rough, brown, deeply cleft, 1 in. thick. *Wood* white, hard. *Pores* moderate-sized, scanty, sometimes subdivided. *Medullary rays* fine, clear, prominent, not equally distant. Faint concentric lines across the rays.

Deccan and Carnatic, both on stony land and on black cotton soil; dry districts of Ceylon.

D 4160. Guttikonda Forest, Kistna (Gamble).

2. C. aphylla, Roth; Fl. Br. Ind. i. 174; Bedd. Fl. Sylv. xiii.; Brandis For. Fl. 14; Talbot Bomb. List 10. Vern. *Karíl*, Pb.; *Kiral*, Sind; *Kari*, Behar; *Kera*, Mar.; *Ker*, Guz.; *Shipri gidda*, Kan.; *Kher*, Merwara.

A small tree with scanty, small, caducous leaves, found only on the young shoots. *Bark* ½ in. thick, grey, corky, with deep irregular cracks. *Wood* light yellow, turning brown on exposure, shining, very hard and close-grained. *Pores* small, often subdivided, generally in radial lines at intervals between the prominent, very short, numerous, wavy, fine *medullary rays*, often filled with resin.

Dry open lands or "rukhs" in the Punjab, Baluchistan, Sind, Guzerat, Rajputana, Central India, the Deccan and S. Carnatic, extending westwards to Arabia and Egypt.

Stewart says, "A curious green twiggy-looking shrub, which has handsome red 'flowers in spring and red fruit in April. It attains at times a considerable size, the 'largest on record being one of 8 ft. girth, mentioned by Edgeworth, near Chichawatni, 'but its ordinary girth is not a fourth of this" ("Punjab Plants," p. 15). The wood is bitter, and is not touched by white ants; it is used for small beams and rafters in roofs (in Sind, for the knees of boats), for oil-mills and agricultural implements; as fuel it answers well for brick-burning; for locomotives it must be mixed with other wood (Stewart and Brandis). Dr. Bonavia, writing in the *Gardener's Chronicle* for Aug.

1884, describes how it is eaten by goats, and so forms a bush which entangles leaves and dust blown by the wind; but when so placed that goats cannot reach it, as on the edges and sides of precipices, it is quite pretty, whether when covered with a profusion of small maize-coloured flowers, or when decked with its rose-coloured berries. Brandis says that its natural reproduction, whether from seed or cuttings, is difficult. It is, with "Jhand" (*Prosopis spicigera*), perhaps the most important tree of the "rukhs" or open forest lands of the Punjab. The buds and fruit are eaten, the latter usually pickled. The young shoots and leaves are used as a blister. Weight 53 to 54 lbs. per cubic foot.

		lbs.
P 444.	Ajmere	—
P 892, 941, 3056.	Multán	53

Nordlinger's Sections, vol. 9.

3. C. grandis, Linn. f.; Fl. Br. Ind. i. 176; Bedd. Fl. Sylv. xiii.; Kurz For. Fl. i. 64; Talbot Bomb. List 10; Trimen Fl. Ceyl. i. 63. *C. bisperma*, Roxb. Fl. Ind. ii. 569. Vern. *Guli, regguti, ragota, nallupi*, Tel.; *Kauntel, Pachoonda*, Mar.; *Pacharan*, Berar; *Torate*, Kan.; *Mudkondai*, Tam.; *Kaunggwa, kawgwa*, Burm.

A small tree. *Bark* thick, extremely irregular, rough, and corky, deeply and irregularly cracked. *Wood* white or greyish-white, moderately hard. *Annual rings* sometimes marked by a broken line of pores. *Pores* scanty, small, moderate-sized or large, arranged irregularly and at intervals between the rays. *Medullary rays* moderately broad, short.

Chanda district, the Deccan, Eastern Ghâts and Carnatic; Dharwar District in Bombay; dry regions of Ceylon; Prome District in Burma.

Wood durable, much used by the natives in the Madras Presidency, according to Beddome. Weight, 46 lbs. per cubic foot.

		lbs.
C 1134.	Ahiri Forest, C.P. (R. Thompson)	46
C 3957.	Bhadrachalam, Upper Godavari (Gamble)	46

Nordlinger's Sections, vol. 10.

4. C. sepiaria, Linn.; Fl. Br. Ind. i. 177; Roxb. Fl. Ind. 568; Brandis For. Fl. 15; Kurz For. Fl. i. 66; Talbot Bomb. List 11; Trimen Fl. Ceyl. i. 64. Vern. *Hiún garna*, Pb.; *Katan*, Jeypore; *Kanti kapali*, Uriya; *Kanthar*, Guz.

A straggling large shrub. *Bark* brown, $\frac{1}{8}$ in. thick, often studded with thorns in pairs. *Wood* white, hard, sometimes with occasional rings of dark liber-like tissue. *Pores* moderate-sized, scanty, in white rings. *Medullary rays* short, fine to moderately broad. Faint white concentric bands across the rays.

Dry thickets throughout India, Burma, and Ceylon. Coast of the Andamans (Kurz). A useful hedge plant.

		lbs.
P 3242.	Ajmere	—
C 3580.	Khurdha, Orissa (Gamble)	—
D 4157.	Remedicherla, Kistna „	47
O 4649.	Kasumri Forest, Saharanpur, N.-W. Provinces (Gamble)	46

This latter specimen has also the incomplete rings of liber tissue noticed under *Niebuhria*, *Mœrua* and *Cadaba*. It was more of a climber than the others.

5. C. multiflora, Hook. f. and Th.; Fl. Br. Ind. i. 178; Kurz For. Fl. i. 61; Gamble Darj. List 5. Vern. *Suntri*, Nep.

A climbing thorny shrub. *Bark* smooth, dark. *Wood* white, moderately hard. *Pores* small, scanty. *Medullary rays* short, fine. Faint concentric lines across the rays.

Eastern Himalaya and Upper Burma.

E 3349. Nagri, Darjeeling, 4000 ft. (Gamble).

6. **C. horrida**, Linn. f.; Fl. Br. Ind. i. 178; Brandis For. Fl. 15; Kurz For. Fl. i. 62; Talbot Bomb. List 11; Trimen Fl. Ceyl. i. 64. *C. zeylanica*, Roxb. Fl. Ind. ii. 567. Vern. *His*, *karvila*, Pb.; *Hins*, *his*, *khalis*, *jhiri*, Dehra Dún; *Karrallua*, Oudh; *Ulta kanta*, *bipua kanta*, Kumaon; *Adonda*, Tel.; *Katerni*, Gondi; *Kalis*, *jhiri*, Hind.; *Gitoran*, Ajmere; *Jhal*, Jeypore; *Waghoti*, Berar; *Bagnai*, Monghyr; *Atanday*, Tam.; *Oserwa*, Uriya; *Wag*, *gowindi*, Mar.; *Nwamanithanbyet*, Burm.; *Welangiriya*, Cingh.

A climbing thorny shrub. *Bark* ¼ in. thick, yellowish-brown, rough. *Wood* white, moderately hard. *Pores* small to moderate-sized, often subdivided, occasionally in long, radial strings, at intervals, scanty. *Medullary rays* moderately broad, not numerous, short. Faint wavy concentric lines.

Most parts of India from the Punjab to Ceylon and Burma, usually in hedges or growing over isolated trees.

Very pretty when in flower. Wood used for fuel; the twigs, shoots and leaves eaten by elephants and goats. The fruit is pickled in the S. Punjab and Sind (Stewart). In dry regions the wood is harder and closer in texture than in those which are fairly wet.

		lbs.
P 3244.	Ajmere	47
D 4171.	Bollapalle Forest, Kistna (Gamble)	38
C 4325.	Chicacole, N. Circars „	37
O 4650.	Kasumri, Saharanpur, N.-W. Provinces (Gamble)	37

7. **C. olacifolia**, Hook. f. and Th.; Fl. Br. Ind. i. 178; Gamble Darj. List 5. Vern. *Naski*, *hais*, Nep.; *Jhenok*, Lepcha.

A thorny shrub. *Bark* ⅛ in. thick, brown, rough. *Wood* white, moderately hard. *Pores* small, often subdivided, or in radial lines. *Medullary rays* fine, numerous, bent where they touch the pores.

Sub-Himalayan tract from Nepal to Assam, chiefly in the undergrowth of Sissu forests along rivers; N. Circars; Shan Hills.

		lbs.
E 3297.	Balasun Forest, Darjeeling Terai (Gamble)	44
C 3832.	Mahendragiri, Ganjam, 4000 ft. „	—

7. ROYDSIA, Roxb., contains three woody climbers. *R. suaveolens*, Roxb. Fl. Ind. ii. 643; Fl. Br. Ind. i. 180; Gamble Darj. List 6; Vern. *Kasonli*, Nep.; *Tunggom*, Lepcha, is found in the tropical forests of Sikkim, Bhutan and the Khasia Hills. *R. obtusifolia*, Hook, f. and Th.; Fl. Br. Ind. i. 180; Kurz For. Fl. i. 67; Vern. *Ngapyu*, Burm., is a large evergreen climbing shrub of the swamp forests of Burma. *R. parviflora*, Griff.; Fl. Br. Ind. i. 409; Kurz For. Fl. i. 67, is also a climbing shrub of Burma, extending north to the Kachin Hills, originally found by Griffith near the Hookoom serpentine mines.

ORDER VIII. RESEDACEÆ.

The Order of the well-known "mignonette." One woody genus only.

1. OCHRADENUS, Delile.

1. **O. baccatus**, Delile; Fl. Br. Ind. i. 182; Talbot Bomb. List 11.

A much-branched shrub. *Wood* yellowish-white, soft. *Pores* of various sizes, small to moderate-sized, arranged in a rough oblique network. *Medullary rays* fine, scanty, the distance between them equal to the diameter of the largest pores.

Sind.

Nordlinger's Sections, vol. 6.

Order IX. VIOLACEÆ.

The Order of the "violets." One woody genus.

1. ALSODEIA, Thouars.

Eight species. *A. Roxburghii*, Wall.; Fl. Br. Ind. i. 186; Kurz For. Fl. i. 69 (*Vareca heteroclita*, Roxb. Fl. Ind. i. 648), is a small shrub of Oudh, Sylhet and the Andaman Islands, the distribution apparently rather strange. *A. zeylanica*, Thw.; Fl. Br. Ind. i. 187; Bedd. Fl. Sylv. t. 229; Trimen Fl. Ceyl. i. 68, is a shrub of Travancore and Ceylon. In Ceylon there are also two endemic species: *A. decora*, Trimen Fl. Ceyl. i. 69, a small tree, and *A. virgata*, Hook. f. and Th.; Fl. Br. Ind. i. 189; Trimen Fl. Ceyl. i. 69, t. 5, a shrub. *A. racemosa*, Hook. f. and Th.; Fl. Br. Ind. i. 187 (*A. longiracemosa*, Kurz For. Fl. i. 70), is a small tree of the tropical forests and upper mixed forests of Martaban and Tenasserim, up to 1500 ft., with a pale brown, close-grained wood. *A. Griffithii*, Hook. f. and Th. and *A. mollis*, Hook. f. and Th., are also Burmese shrubs, the former of Upper Burma, the latter of Tenasserim.

1. **A. bengalensis**, Wall.; Fl. Br. Ind. i. 186; Kurz For. Fl. i. 70; Gamble Darj. List 6. Vern. *Kalipat*, Nep.; *Kyadoo*, And.

A shrub or small tree. *Wood* white, scented, with numerous faint concentric lines of soft tissue. *Pores* scanty, moderately large. *Medullary rays* moderately broad, wavy.

Lower Sikkim Hills, in damp valleys; Sylhet; tropical forests, also entering drier hill forests, of Pegu and Martaban, up to 4000 ft.; common in Andaman Islands.

B 3198. Andaman Islands (Home, 1874, No. 26).

The identification of this specimen is not quite certain, but is probably correct, as it was confirmed by Kurz (see Brandis's Memo. on the Forest Resources of the Andamans, dated Aug. 25, 1874).

Order X. BIXINEÆ.

A somewhat miscellaneous Order, but one of some importance in Forest Economy, as it contains a few species of value in sylviculture or on account of their products. There are three Tribes, with 13 genera, one of which contains only an introduced plant, which, however, is now practically wild and belongs to the Flora.

Tribe I. Bixeæ	Cochlospermum, Bixa.
„ II. Flacourtieæ . . .	Scolopia, Erythrospermum, Flacourtia, Bennettia, Xylosma, Aberia.
„ III. Pangieæ	Gynocardia, Trichadenia, Hydnocarpus, Taraktogenos, Asteriastigma.

Wood usually reddish-brown, moderately hard or hard. *Pores* small, in short radial lines. *Medullary rays* fine, numerous, closely packed. The structure closely resembles that of the red-wooded section of *Euphorbiaceæ*. *Cochlospermum* has an extremely soft wood of different structure.

1. COCHLOSPERMUM, Kunth.

1. **C. Gossypium**, DC; Fl. Br. Ind. i. 189; Bedd. Fl. Sylv. xiv.; Brandis For. Fl. 7; Kurz For. Fl. i. 72; Talbot Bomb. List 12; Trimen Fl. Ceyl. i. 20. *Bombax Gossypium*, Roxb. Fl. Ind. iii. 169. Vern. *Kûmbi, gabdi, ganiár, galgal, gangal*, Hind.; *Gejra, arlu*, Saharanpur; *Ganer, chaor*, Melghat; *Ganglay, galgal*, Mar.; *Ganeri*,

Bhil; *Gangam*, Gondi; *Húpú*, Kól, Sonthal; *Onkúr*, Saora; *Konto palás, bendia murdoni, popso koniári*, Uriya; *Gúngú, kong, kandugogu, konda buraga, pethiri puliki*, Tel.; *Kád buraga*, Kan.; *Tanaku, elluva, kongu, kongillam*, Tam.; *Appakodakka*, Mal.; *Kinihiriya, Ela-imbúl*, Cingh.

A small deciduous tree, with short, thick, spreading branches. *Bark* 1 in. thick, fibrous, deeply furrowed; inner substance red. *Wood* extremely soft, greyish-brown; no heartwood. *Pores* large, scanty, often subdivided into compartments. *Medullary rays* broad, visible on a radial section as long rough plates.

Forests at the base of the West Himalaya, from the Sutlej eastwards; Guzerat, Central India, Deccan, Prome District in Burma; cultivated in Ceylon near temples.

The wood is quite useless, being when dry nothing but a loose bundle of fibres, when green a soft spongy mass. The tree is characteristic of the hottest, dryest, stoniest slopes, and is always conspicuous, whether leafless but covered with large brilliant yellow flowers, or in full foliage with its glossy green digitately-lobed leaves, or when the large capsules are opening to let loose the cotton-covered seeds. This cotton is one of the silk cottons or "Kapok fibres" of India, and, though useless for textile purposes, can be used for stuffing pillows, for which it is even better than that of *Bombax*. The seeds give an oil which is little used. The gum, of a clear white colour, is known as "katira," it is insoluble in water, but, according to Baden-Powell, used in the shoemaking trade. The bark gives a cordage fibre. Though of no value for its wood, the tree is useful sylviculturally as helping to reafforest bare rocky denuded hills, and so pave the way for more valuable species.

		lbs.
C 1141.	Ahiri Reserve, C.P. (R. Thompson)	17
C 3958.	Bhadrachalam Forests, Upper Godavari (Gamble) . . .	17

2. BIXA, Linn.

1. B. Orellana, Linn.; Roxb. Fl. Ind. ii. 31; Fl. Br. Ind. i. 190; Bedd. Fl. Sylv. t. 19; Brandis For. Fl. 17; Kurz For. Fl. i. 72; Gamble Darj. List 6; Talbot Bomb. List 12; Trimen Fl. Ceyl. i. 70. The Arnotto. Vern. *Latkan, natkána*, Hind., Beng.; *Jarat*, Ass.; *Jafra*, Tel.; *Kuragúmangjal*, Tam.; *Kuppamanhala, rangamali*, Kan.; *Kisri, sendri*, Bombay; *Thi-din*, Burm.; *Kaha*, Cingh.

A large shrub or small tree. *Bark* brown, ⅛ inch thick. *Wood* pinkish-white, soft, even-grained. *Annual rings* marked by a line without pores. *Pores* moderate-sized, in radial strings of 3 to 6, prominent on a vertical section. *Medullary rays* fine, closely packed, bent round the pores or groups of pores, so that the distance between the rays is less than the transverse diameter of the pores.

Indigenous in America, and thence introduced into India and cultivated for the red dye obtainable from the pulp surrounding the seeds. The dye can be made to give various shades of red and orange, and is in considerable demand (for further information, see Watt. Dict. Econ. Products), especially for colouring butter. It is a very handsome plant, and is often planted for ornament, especially in Ceylon. Beddome says it is quite naturalized in S. India. Growth moderate, 5 rings per inch of radius.

E 3401. Jalpaiguri, Bengal (Gamble).

3. SCOLOPIA, Schreber.

Trees, usually spinous. There are five species in India, Burma and Ceylon. *S. Roxburghii*, Clos.; Fl. Br. Ind. i. 190; Kurz For. Fl. i. 73, is an evergreen tree of Tenasserim "dreadfully armed with long, strong, straight and compound spines" (Kurz); and *S. lucida*, Wall.; Kurz For. Fl. i. 73, is also an evergreen tree of the same region.

1. **S. rhinanthera,** Clos.; Fl. Br. Ind. i. 190.

An evergreen tree. *Wood* red, hard. *Pores* small, in short radial lines. *Medullary rays* very fine, closely packed.

Malay Peninsula; Andamans (?).

The specimen is of Kurz' own collecting, and the identification is his, but the species has otherwise not yet been recorded from the Andaman Islands.

	lbs.
B 1969. Andamans (Kurz, 1866)	60

2. **S. crenata,** Clos.; Fl. Br. Ind. i. 191; Bedd. Fl. Sylv. t. 78; Talbot Bomb. List 12. *S. acuminata*, Clos. and *S. crassipes*, Clos.; Trimen Fl. Ceyl. i. 70–71. Vern. *Hitterlú, terené*, Badaga; *Dodda jepalu, japle*, Kan.; *Charalu*, Trav. Hills; *Katukenda*, Cingh.

A small tree. *Bark* smooth, rufous-grey, the branches and stem thorny when young. *Wood* reddish-brown, hard, close- and even-grained. *Pores* small or moderate-sized, subdivided or in short radial lines. *Medullary rays* fine, very numerous, close, bent round the pores.

Western Gháts, in the Konkan, Kanara, Mysore and Malabar, common in Nilgiri sholas; hills of Ceylon.

Beddome says the wood is so hard as to resist the saw and injure tools. Trimen's two species ought probably to be kept separate; *S. acuminata* being a small tree of the low country, and *S. crassipes* a "very large tree" of the hill region. It is probably to this that the specimen described should be attributed.

Ceylon: Int. Exhn., 1862—Kew Museum.

3. **S. Gaertneri,** Thw.; Fl. Br. Ind. i. 191; Bedd. Fl. Sylv. xv.; Trimen Fl. Ceyl. 71. Vern. *Katu-kurundu*, Cingh.

A moderate-sized tree, the trunk beset with large, woody, compound, branched spines. *Bark* grey. *Wood* reddish-brown, rather soft. *Pores* moderate-sized, scanty, often subdivided. *Medullary rays* fine, regular, numerous.

Low country of Ceylon, up to 1500 ft.; Travancore (Bourdillon).

The wood is used for the handles of tools, and in cart-building.

Ceylon Collection, new, No. 66 (Mendis).

4. ERYTHROSPERMUM, Lam. *E. phytolaccoides*, Gard.; Fl. Br. Ind. i. 191; Bedd. Fl. Sylv. xv.; Trimen Fl. Ceyl. i. 72, t. 6, is a small endemic tree of the moist low country of Ceylon.

5. FLACOURTIA, Commers.

Seven Indian trees or shrubs, often spinous. *F. sumatrana*, Planch.; Fl. Br. Ind. i. 192; Kurz For. Fl. i. 74, and *F. mollis*, Hook. f. and Th.; Fl. Br. Ind. i. 192; Kurz For. Fl. i. 74, are trees of Tenasserim. *F. inermis*, Roxb. Fl. Ind. iii. 833; Fl. Br. Ind. i. 192; Bedd. Fl. Sylv. xvi.; Kurz For. Fl. i. 74; Vern. *Tomitomi*, Mal.; *Ubbolu*, Kan., is a tree of Sylhet, S. India, and Burma with an edible fruit, perhaps introduced. *F. montana*, Grah.; Fl. Br. Ind. i. 102; Bedd. Fl. Sylv. xvi.; Talbot Bomb. List 12; Vern. *Attak, champer*, Mar.; *Han Sampige*, Kan., is a tree of the Western Gháts with a pleasant fruit.

1. **F. Cataphracta,** Roxb. Fl. Ind. iii. 834; Bedd. Fl. Sylv. xvi.; Kurz For. Fl. i. 74; Talbot Bomb. List 13. Vern. *Paniála, panizali*, Beng.; *Pachnala, jamuna*, Dehra Dún; *Talispatri, paniála*, Hind.; *Vayangkarei*, Tam.; *Thallira*, Mal.; *Jugguru*, Bomb.; *Abblu*, Kan.; *Naywè*, Burm.

A small tree with compound spines on the trunk. *Wood* red or orange-red, hard, brittle. *Pores* numerous, small, often subdivided. *Medullary rays* very numerous, fine, closely-packed.

Damp forests in Dehra Dún, and thence but scarce through Bengal, Chota Nagpore, Assam and Chittagong to S. India and Burma. Often cultivated for its fruit.

		lbs.
O 4511.	Nakraunda, Dehra Dún (Gamble)	52
W 4631.	Travancore (Bourdillon)	54

Nordlinger's Sections, vol. 9 (Tab. I. 3).

2. **F. Ramontchi,** L'Herit.; Fl. Br. Ind. i. 193; Bedd. Fl. Sylv. xvi.; Brandis For. Fl. 18; Talbot Bomb. List 13; Trimen Fl. Ceyl. 23. *F. sapida*, Roxb. Fl. Ind. iii. 835; Kurz For. Fl. i. 75. Vern. *Kúkai, kakoa, kókoa, kangú, kandei*, Pb.; *Bilangra, bhanber, kanjú, kango, kandi, kattár, katti*, Hind.; *Kala kandei*, Kumaon; *Bila gura*, Garhwal; *Tambat, paker, kaker, bhekal*, Mar.; *Kaikun, khakeran*, Merwara; *Kakai, gargati, parbekat*, Berar; *Baincha*, Monghyr; *Kangori*, Jeypore; *Merlé*, Sonthal; *Benti*, Mal Pahari; *Serali, merlo*, Kól; *Katail*, Palamow; *Bali baincho, potwa, bonicha*, Uriya; *Sapka*, Khond; *Múlú anám*, Palkonda; *Kondagogu, kanregu, pedda-kanru, kaka, nakka-naregu, puli-eliki*, Tel.; *Katukali*, Tam.; *Ugúrassa*, Cingh.; *Naywè*, Burm.

A small thorny deciduous tree. *Bark* grey. *Wood* red, hard, close- and even-grained, splits but does not warp, and is durable. *Pores* small, in radial lines. *Medullary rays* fine, uniform, closely-packed and somewhat wavy.

Dry hills throughout India; Prome district and Shan Hills in Burma; Ceylon.

A very common small tree in the deciduous forests. The wood is used for turning and agricultural implements, the fruit and leaves are eaten, and the branches are lopped for cattle-fodder. Weight: Brandis gives 50 lbs. per cubic foot, specimens examined give 53 lbs.

		lbs.
P 460.	Ajmere	52
P 3221.	Nagpahar, Ajmere	—
O 260.	Garhwal (1868)	50
C 2739.	Moharli Reserve, C.P. (Brandis)	52
B 3125.	Burma (Brandis, 1862)	59
C 3453.	Saidope Reserve, Palamow (Gamble)	—
C 3488.	Kolhán Forests, Singbhúm „	51

3. **F. sepiaria,** Roxb. Fl. Ind. iii. 835; Fl. Br. Ind. i. 194; Bedd. Fl. Sylv. xvi.; Brandis For. Fl. 18; Kurz For. Fl. i. 75; Talbot Bomb. List 13; Trimen Fl. Ceyl. i. 73. *F. rotundifolia*, Clos.; Kurz For. Fl. i. 75. *F. obcordata*, Roxb. Fl. Ind. iii. 835. Vern. *Sharawani, dajkar, jidkar*, Hind.; *Tambat*, Mar.; *Kanru*, Tel.; *Baincha*, Uriya.

A small thorny shrub. *Bark* yellowish-red, thin. *Wood* light red, hard, close- and even-grained. *Pores* very small in radial lines. *Medullary rays* very fine, uniform, closely packed, wavy.

Dry forests in Peninsular India, Burma and the upper slopes of the Andamans; dry regions of Ceylon; Brandis says it has been found in Kumaon.

A common shrub of the dry evergreen forests, of no particular use.

		lbs.
C 3519.	Khurdha Forests, Orissa (Gamble)	—

6. **BENNETTIA,** Miq. *B. longipes*, Oliv.; Hook. Ic. Pl. t. 1596, is a small tree of Sylhet.

7. XYLOSMA, Forster.

Three species. *X. controversum*, Clos.; Fl. Br. Ind. i. 194, is a tree of Nepal and the Khasia Hills, nearly allied to *X. longifolium*. *X. latifolium*, Hook. f. and Th.; Fl. Br. Ind. i. 194, is a large thorny tree of the Bababuden Hills in Mysore.

1. X. longifolium, Clos.; Fl. Br. Ind. i. 194; Brandis For. Fl. 19, t. 4. Vern. *Chopra, chirúnda, chirudi, drendu*, Pb.; *Kattáwa*, Oudh; *Dandál, katári, sialu, kandhára*, Hind.; *Phalama*, Garhw.

A small evergreen tree. *Bark* $\frac{1}{6}$ in. thick, grey, rough. *Wood* pinkish-brown, roughish, moderately hard, even-grained. *Pores* small, in short radial lines. *Medullary rays* wavy, very fine and closely packed, with a satiny silver-grain.

North-West Himalaya, ascending to 5000 feet, Assam, Chota Nagpore, N. Circars. A common plant in shady ravines. The wood is used for fuel only.

		lbs.
H 2947.	Jander, Sutlej Valley, 3500 feet (Gamble)	55
O 5005.	Dehra Dún (R. C. Milward)	45

8. ABERIA, Hochst. *A. Gardneri*, Clos.; Fl. Br. Ind. i. 195; Trimen Fl. Ceyl. i. 74, t. 7. Vern. *Ketambilla*, Cingh., is a small endemic tree of the lower hills of Ceylon up to 4000 ft., with an edible fruit.

9. GYNOCARDIA, R. Br.

1. G. odorata, R. Br.; Fl. Br. Ind. i. 195; Kurz For. Fl. 76; Gamble Darj. List 6. *Chaulmoogra odorata*, Roxb. Fl. Ind. iii. 835. Vern. *Chaulmúgri, petarkura*, Beng.; *Kadu*, Nep.; *Túk*, Lepcha; *Toungpung*, Magh.

A moderate-sized evergreen tree, readily recognized by the hard, round fruits which grow on the stem and main branches. *Bark* ¼ in. thick, grey, smooth. *Wood* hard, close-grained, yellow or light brown. *Pores* very small, in radial lines. *Medullary rays* white, very numerous and prominent.

Northern and Eastern Bengal and Assam; Chittagong and Burma.
The wood is used in Chittagong for planking and for posts, and the pulp of the fruit in Sikkim to poison fish.

		lbs.
E 708.	Chittagong (Chester)	47

10. TRICHADENIA, Thw.

1. T. zeylanica, Thw.; Fl. Br. Ind. i. 196; Trimen Fl. Ceyl. i. 75, t. 8. Vern. *Tolol, titta*, Cingh.

A very large tree. *Wood* yellowish-white, hard. *Pores* moderate-sized, often subdivided, rather scanty, in radial patches. *Medullary rays* fine, very close, regular, bent round the pores.

Moist low country of Ceylon.
Trimen says the wood is useless, and that an oil is obtained from the seeds and used in skin-diseases and for burning. The tree is now scarce, owing to the extensive clearings of forest.

Ceylon: Int. Exhn., 1862—Kew Museum.

11. HYDNOCARPUS, Gaertn.

Five species. *H. octandra*, Thw. is a tree of the low country of Ceylon. *H. castanea*, Hook. f. and Th.; Fl. Br. Ind. i. 197, is a tree of Tenasserim, the Mergui Archipelago and the Andamans.

1. **H. alpina,** Wt.; Fl. Br. Ind. i. 197; Bedd. Fl. Sylv. t. 77; Trimen Fl. Ceyl. i. 77. Vern. *Maratalti*, Badaga; *Sanna solti*, Kan.; *Attuchankalai*, Tam.; *Gomma*, Cingh.

A large tree. *Bark* greyish-brown, slightly rough, ¼ in. thick. *Wood* light brown, hard, with streaks of darker colour and clearly containing tannin. *Annual rings* faint. *Pores* moderate-sized, often subdivided radially into 2 or 3, scanty. *Medullary rays* fine, very numerous and closely packed, the distance between them much less than the transverse diameter of the pores.

A large tree, very common in the sholas on the eastern side of the Nilgiris up to 6000 ft., throughout the Western Gháts, and in Ceylon.

Wood fair, "used for beams and rafters, and a good fuel" (Beddome). Growth good, 5 rings per inch of radius.

		lbs.
W 4286.	Hulikal, Nilgiris, 5000 ft. (Gamble)	40

2. **H. Wightiana,** Bl.; Fl. Br. Ind. i. 196; Bedd. Fl. Sylv. xvi.; Talbot. Bomb. List 13. Vern. *Maravetti*, Tam.; *Kowti, kastel, kantel*, Mar.; *Toratti*, Kan.; *Yetti*, Kader; *Kodi nirvetti*, Trav. Hills.

A tree. *Wood* whitish. *Pores* numerous, small, often subdivided. *Medullary rays* fine, very numerous and closely packed.

Forests of the Malabar coast from the Konkan southwards.

The wood is fair and occasionally used; weight about 33 lbs. per cubic foot. Bourdillon gives 33 lbs., and P = 464. The seeds give a lamp-oil.

		lbs.
W 4529, W 4712.	Travancore (Bourdillon)	31 and 36

3. **H. venenata,** Gaertn.; Fl. Br. Ind. i. 196; Trimen Fl. Ceyl. i. 75. Vern. *Makulu*, Cingh.; *Makal*, Tam.

A tree. *Bark* smooth, whitish. *Wood* light yellow, hard, close-grained. *Pores* small, scanty, in pairs or threes. *Medullary rays* fine, regular, not prominent.

Low country of Ceylon, on river-banks, up to 2000 ft.

The fruits are used as a fish-poison, and the oil given by the seeds in skin-diseases (Trimen).

Ceylon: Int. Exhn., 1862—Kew Museum.

12. TARAKTOGENOS, Hassk. *T. Kurzii*, King in Journ. As. Soc. Beng. lix. ii. 630 (*Hydnocarpus heterophylla*, Kurz For. Fl. i. 77, *non* Bl.); Vern. *Kalanzo*, Burm., is a tree of the forests of Sylhet, Chittagong and Burma, the seeds of which give the well-known *Chaulmugra* oil, which is valuable for the treatment of cutaneous diseases, especially dysentery (see Prain in Ann. Report R. Bot. G. Calc. 1900–1901).

13. ASTERIASTIGMA, Bedd.

1. **A. macrocarpa,** Bedd. Fl. Sylv. t. 166. Vern. *Vellei nángu*, Tam.

A large tree. *Wood* grey, soft. *Pores* small, in radial lines between the fine even *medullary rays*, which are bent where they touch them.

On the Ghát between Cottyam and Peermerd in Travancore, 2000 ft.

		lbs.
W 4689.	Travancore (Bourdillon).	35

ORDER XI. PITTOSPOREÆ.

1. PITTOSPORUM, Banks.

This genus contains about nine Indian species, small trees or shrubs, chiefly of hill regions, and of but little importance. But they have pretty, often sweet-scented, flowers and bright foliage, and are all deserving of cultivation, just as are cultivated in European gardens so many species from Australia, New Zealand, Japan and the Cape. *P. glabratum*, Ldl. and *P. humile*, Hook. f. and Th.; Fl. Br. Ind. i. 198, are both shrubs of the Khasia Hills, found above 4000 ft. *P. ceylanicum*, Wight; Fl. Br. Ind. i. 199; Trimen Fl. Ceyl. i. 78. Vern. *Ketiya*, Cingh., is an endemic small tree of Ceylon, found in the moist low country and hills up to 6000 ft. *P. dasycaulon*, Miq.; Fl. Br. Ind. i. 199; Talbot Bomb. List 13; Vern. *Gapsundi*, Mar., is a small tree of W. India in the Konkan, Kanara and Belgaum. *P. ferrugineum*, Ait.; Fl. Br. Ind. i. 199; Kurz For. Fl. i. 78, is a spreading tree of Tenasserim, and from thence southwards to Australia.

Among species in cultivation: *P. undulatum*, Vent., an Australian shrub, is much grown in gardens in the Nilgiris. In Australia its wood is used as a substitute for box-wood (Kew Museum). *P. Tobira*, Dryand. is a sweet-scented Japanese shrub much cultivated in Europe, and probably also in gardens in the Indian Hill stations.

Bark thin, lenticellate. *Wood* white, moderately hard, even-grained. *Annual rings* faintly marked. *Pores* small, rather scanty and irregularly distributed. *Medullary rays* fine, prominent, not numerous, pale.

1. **P. tetraspermum**, W. and A.; Fl. Br. Ind. i. 198; Bedd. Fl. Sylv. xvii.; Trimen Fl. Ceyl. i. 77. Vern. *Kaimaru*, Badaga; *Kaccha patti*, Trav. Hills.

A small tree. *Bark* greyish-brown, thin, peeling off in small flakes, lenticels horizontal. *Wood* white, moderately hard. *Pores* small, scanty, often subdivided, arranged somewhat in concentric rings. *Medullary rays* fine, white, short.

Hills of N. Circars, Nilgiris and Ceylon, 7000 ft.

		lbs.
C 3778.	Mahendragiri Hill, Ganjam, 4500 ft. (Gamble) . . .	48
W 3862.	Aramby Forest, Ootacamund, Nilgiris, 7000 ft. (Gamble) .	—

2. **P. nilghirense**, W. and A.; Fl. Br. Ind. i. 198; Bedd. Fl. Sylv. xvii.

A small tree. *Bark* dark grey, with white horizontal lenticels. *Wood* white, moderately hard, with a strong fennel-like odour when fresh cut. *Pores* very small, scanty, in short oblique lines. *Medullary rays* fine, white, rather short.

Nilgiri Hills, above 5000 ft.; Satyamangalam Hills.

W 3761. Coonoor, Nilgiris, 6000 ft. (Gamble).
D 4936. Satyamangalam Hills, Coimbatore (A. Lushington).

3. **P. floribundum**, W. and A.; Fl. Br. Ind. i. 199; Bedd. Fl. Sylv. xvii.; Brandis For. Fl. 19; Gamble Darj. List 6; Talbot Bomb. List 13. *Celastrus verticillata*, Roxb. Fl. Ind. i. 624. Vern. *Tumri*, Garhwal; *Raini*, Kumaon; *Yekaddi*, Mar.; *Prongzam*, Lepcha.

A small evergreen tree. *Bark* very thin, light greenish-grey with very prominent horizontal lenticels, up to nearly ½ in. long. *Wood* white, moderately hard, close-grained. *Pores* small, often subdivided or in strings, scanty and irregularly distributed. *Medullary rays* fine to moderately broad.

Sub-Himalayan tract and Lower Himalaya, from the Jumna to Sikkim, along rivers and in ravines; Khasia Hills; Western Coast Districts; Shan Hills of Burma.

A handsome evergreen tree deserving of cultivation for ornament.

		lbs.
O 4836.	Ramgarh, Dehra Dún (U.N. Kanjilal)	40

4. P. eriocarpum, Royle; Fl. Br. Ind. i. 199; Brandis For. Fl. 19. Vern. *Meda túmri, gar-silung, garshúna,* Hind.; *Agni,* Kumaon; *Kakria,* Dotiál.

A small tree. *Bark* silvery grey, very thin, with prominent rounded or slightly horizontal lenticels. *Wood* white, moderately hard, even-grained. *Annual rings* marked by a white line. *Pores* small, in small clusters or oblique groups. *Medullary rays* fine, prominent, rather scanty.

Outer Himalaya from the Jumna to the Sarda at 3–6000 ft.; common below Mussooree.

A handsome evergreen tree, easily recognized from other species by its tomentose young leaves and fruit.

		lbs.
H 4839.	Jharipani, Mussoorie, 4000 ft. (U.N. Kanjilal)	45

ORDER XII. POLYGALEÆ.

Three Indian genera of woody plants: Polygala, Securidaca and Xanthophyllum. *Muraltia juniperifolia,* DC, from the Cape, a pretty thorny shrub with purple flowers, has become naturalized on the Nilgiris.

1. POLYGALA, Linn.

Milkworts. A genus of herbs for the most part, one Indian species only reaching the size of a shrub.

1. P. arillata, Hamilt.; Fl. Br. Ind. i. 200; Gamble Darj. List 6; Trimen Fl. Ceyl. i. 79. *Chamæbuxus arillata,* Hassk.; Kurz For. Fl. i. 79. Vern. *Karimui,* Nep.; *Michepnor,* Lepcha.

A large shrub. *Bark* thin, greyish-white. *Wood* white, moderately hard, close- and even-grained. *Pores* moderate-sized, scanty, single or in short radial lines. *Medullary rays* short, fine, scanty, the distance between them about equal to the diameter of the pores. *Annual rings* well marked by a white line.

Hills of the Eastern Himalaya at 5–8000 ft.; Khasia Hills; Nilgiris; hills of Upper Burma; Ceylon, at 4–7000 ft., in the montane zone.

A graceful shrub with pretty yellow flowers; reaching a fairly large size in the Nilgiris and Ceylon. Growth slow, 12 rings per inch of radius. The root is said to be used in the fermentation of murwa beer by Bhutias, and the wood to procure fire by friction.

		lbs.
E 3393.	Jalapahar, Darjeeling, 7500 ft. (Gamble)	—
W 4040.	Lovedale, Ootacamund, 7000 ft. „	44

2. SECURIDACA, Linn. *S. tavoyana,* Wall.; Fl. Br. Ind. i. 208 (*S. inappendiculata,* Hassk.; Kurz For. Fl. i. 80), is a large woody climber of Eastern Bengal, Arracan and Tenasserim, with crimson flowers. It has recently been discovered also in the Kachin Hills near Myitkyina. The *wood* of plants of the genus is usually in alternate belts, as in some *Capparideæ* and *Dalbergia paniculata.*

3. XANTHOPHYLLUM, Roxb.

Four species. *X. affine*, Korth.; Fl. Br. Ind. i. 209; Kurz For. Fl. i. 82, and *X. Griffithii*, Hook. f.; Fl. Br. Ind. i. 210 (*X. eglandulosum*, Griff.; Kurz For. Fl. i. 81), are evergreen trees of Tenasserim.

1. **X. flavescens,** Roxb. Fl. Ind. ii. 222; Fl. Br. Ind. i. 209; Kurz For. Fl. i. 81; Trimen Fl. Ceyl. i. 84. *X. Arnottianum*, Wight; *X. angustifolium*, Wight; and *X. virens*, Roxb. Fl. Ind. ii. 221; Bedd. Fl. Sylv. xix. Vern. *Ajensak*, *gandi*, Beng.; *Thitpyu*, Burm.; *Mattei*, Tam.; *Madaku*, Mal.; *Palala*, Cingh.

A large tree. *Wood* white or yellowish-white, hard, close-grained, with many pale, closely-packed concentric bands. *Pores* large, very scanty. *Medullary rays* exceedingly fine and numerous.

Eastern Bengal, Burma, South India and Ceylon, up to 4000 ft. in evergreen forests.

Clearly a useful wood, but rarely of very large size in South India. Bourdillon's experiments of 1896 give W = 48 lbs., P = 567.

		lbs.
W 4633.	Travancore (Bourdillon)	51

2. **X. glaucum,** Wall.; Fl. Br. Ind. i. 209; Kurz For. Fl. i. 81. Vern. *Thitpyu*, Burm.

An evergreen tree. *Bark* ½ in. thick, dark grey with distant, deep, very long, horizontal clefts. *Wood* light grey, moderately hard, with many dark concentric bands of loose texture. *Pores* small, scanty, often subdivided. *Medullary rays* very fine, very numerous, inconspicuous.

Swamp forests and inundated jungle-swamps of the alluvial hills and bases of the hills of Pegu, Martaban and Tenasserim (Kurz), Kachin Hills of Upper Burma.

Kurz describes the wood as comparatively strong, and probably valuable for furniture; W = 30 to 38 lbs., breaking weight 155 to 179 lbs. Three specimens have been sent as the wood of this species; that described is only the most probably correct one—the others are B 5049 from Bassein, and B 5059 from Henzada. They are all grey woods, but differ from each other in bark and structure. The Vernacular name of *Thitpyu*, meaning "white wood," might be given to many trees, and an officer not personally determining a tree botanically, and relying only on the Vernacular name, might easily be deceived.

		lbs.
B 5072.	Thaungyin, Burma	35

ORDER XIII. TAMARISCINEÆ.

A small Order containing bushes or small trees with small sessile or scale-like sheathing leaves: two genera, *Tamarix* and *Myricaria*.

Wood white or reddish, sometimes darker in the centre, but no heart-wood. *Pores* small to moderate-sized, often in groups, more numerous and large in the spring wood if the annual rings are distinct. *Medullary rays* generally moderately broad to broad, short, distant, giving a marked silver-grain.

1. TAMARIX, Linn.

Seven species, bushes or small trees with scale-like leaves and white or pink flowers, chiefly found on the banks of streams and on the lowlands near rivers. The two principal species along the Ganges and other chief Indian rivers are *T. gallica*, L. and *T. dioica*, Roxb., species which, as Brandis says, are easily mistaken for each other. *T. ericoides* is a low shrub frequenting rocky river-beds in Central and Western India instead of the sandy "churs" affected by the others. *T. salina*, Dyer in Fl. Br. Ind. i. 248, is a glabrous glaucous shrub of the Punjab Salt Range, and *T. stricta*, Boiss.; Fl. Br. Ind. i. 249; Talbot Bomb. List 14 is a tree of Sind and Baluchistan allied to *T. articulata*. *T. macrocarpa*, Bunge; Vern. *Kirzi*, *gaz-surkh*, Baluch.; *Gazlei*, Sind, is a large shrub of Baluchistan said by Lace to be one of the chief camel fodders in Peshin.

1. **T. gallica**, Linn.; Fl. Br. Ind. i. 248; Bedd. Fl. Sylv. xx.; Brandis For. Fl. 20, t. 5; Kurz For. Fl. i. 83; Talbot Bomb. List 14; Trimen Fl. Ceyl. 91. *T. indica*, Roxb. Fl. Ind. ii. 100. The Tamarisk. Vern. *Koan*, *rúkh*, *leinya*, *ghazlei*, *pilchi*, Pb.; *Lei*, *lái*, *jhau*, Sind; *Jhau*, *nuna*, Beng.; *Palivi*, Tel.; *Kiri*, Tam.

A shrub or small tree. *Bark* rough, greenish-brown, that of young branches reddish-brown, smooth, with small whitish specks. *Wood* whitish, occasionally with a red tinge, open- and coarse-grained, fairly hard and tough, but not strong. *Pores* small and moderate-sized, numerous, more so in spring wood. *Medullary rays* numerous, broad but short. *Annual rings* distinct (Brandis).

Throughout India from the Western Himalaya to Burma and Ceylon; extending westwards to Europe, eastwards to China and Japan, and southwards to Africa.

Banks of rivers and near the sea-coast, often on salt lands.

The wood is largely used for fuel for steamers and otherwise, and in Sind and the Punjab for agricultural implements, turning, and lacquered work. Mathieu in Fl. For. gives the weight at 40 to 48 lbs. per cubic foot.

Nordlinger's Sections, vol. 1.

2. **T. dioica**, Roxb. Fl. Ind. ii. 101; Fl. Br. Ind. i. 249; Bedd. Fl. Sylv. xx.; Brandis For. Fl. 21, t. 6; Kurz For. Fl. i. 83; Gamble Darj. List 6; Talbot Bomb. List 14. Vern. *Lei*, *pilchi*, *koan*, *kachlei*, Pb.; *Gaz*, *láo*, *jhau*, Sind; *Lal jhau*, Beng.; *Jhau*, Hind.

A gregarious shrub or small tree. *Bark* grey, with reticulate cracks, showing the red inner bark. *Wood* moderately hard, red, outer portion white. *Pores* small to moderate-sized, in groups or short radial lines, more abundant and larger in the spring wood. *Medullary rays* very prominent, short, fine to very broad, very prominent on a radial section. The distance between the rays is generally three or four times the transverse diameter of the pores.

Throughout India from Sind and the Punjab to Assam, S. India and Burma.

The wood is chiefly used for fuel, for baskets and brooms, also for native hut-building. The galls are used in dyeing as a mordant, and in tanning; also as an astringent in medicine. It gives a gum of a bitter-sweet flavour. The growth is very fast; the experiments recorded by Minniken in his Report of 1878 on the Delhi Bela plantation give an average rate of 1·4 rings per inch of radius. Weight, 49 lbs. per cubic foot.

		lbs.
P 888.	Multán, Punjab (Shakespear)	48
P 1388.	Lahore, Punjab (Baden-Powell)	51

3. **T. articulata**, Vahl.; Fl. Br. Ind. i. 249; Bedd. Fl. Sylv. xx.; Brandis For. Fl. 22, t. 7; Talbot Bomb. List 14. *T. orientalis*, L.; Stewart Pb. Plants 92. Vern. *Farás*, *farwa*, *rúkh*, *ukhan*, *kharlei*, *narlei*, Pb.; *Asrelei*, Sind.

A moderate-sized tree. *Bark* grey, rough. *Wood* white, moderately hard. *Annual rings* indistinct. *Pores* moderate-sized, often in groups or subdivided or singly between the medullary rays, scanty. *Medullary rays* short, fine to very broad, the distance between the rays somewhat greater than the transverse diameter of the groups of pores; prominent on a radial section as irregularly shaped plates, giving the wood a handsome silver-grain.

The Punjab and Sind, Baluchistan, extending westward to Egypt, often cultivated. One of the most important trees of the arid regions. It sometimes reaches 60 ft. in height, with spreading branches and the general appearance of a conifer. The twigs are often hoary with a saline efflorescence. The wood is used for many purposes—for ploughs, Persian wheels, small ornaments, fuel, and charcoal. The green wood when burnt gives an offensive smell, but it is not considered a good railway fuel. The bark and the galls (*Mái*, Pb.; *Sakun*, Sind) are used in tanning. The wood weighs 40 to 60 lbs. per cubic foot when seasoned, 92 lbs. (according to Stewart) when green. The growth of the tree seems to be rapid, for Brandis mentions trees that have reached 2 to 3 ft. in girth in 12 years, and one which measured 4 ft. 10 in. at 15 years old. It reproduces well either by seed or from cuttings; and coppices well. The Cerambycid borer *Pachydissus holosericeus*, Fabr., has been found in this tree in Dera Ismael Khan.

		lbs.
P 886.	Multán, Punjab (Shakespear)	61
	Nordlinger's Sections, vol. 6.	

4. **T. ericoides**, Rottl.; Fl. Br. Ind. i. 249; Bedd. Fl. Sylv. xx.; Talbot Bomb. List 14. Vern. *Javra*, Merwara; *Jao*, *sarab*, *sarata*, Mar.

A shrub. *Bark* dark brown, vertically cleft. *Wood* moderately hard, reddish-white. *Pores* small to moderate-sized, often in groups and more numerous in the inner part of each ring. *Medullary rays* moderately broad, the distance between them greater than the transverse diameter of the pores or groups of pores.

Beds of rivers in Bengal, Central, Southern and Western India. A pretty heath-like shrub, usually found associated with such river-bed plants as *Rhabdia viminea* and *Homonoya riparia*.

C 3648. Kechki, Palamow, Chota Nagpore (Gamble).
D 4168. Ketavaram, Kistna (Gamble).

2. MYRICARIA, Desvaux.

The genus contains, besides the species given below, *M. elegans*, Royle; Fl. Br. Ind. i. 250, a small bush of the inner Western Himalaya and Tibet, where it is very valuable as fuel. T. Thomson in "W. Himalaya and Tibet," p. 162, describes the exceptional growth of *Myricarias* (he does not say which species) in the valley of the Pugha river, a tributary of the Indus, in Ladak, occasioned by the presence of hot springs. The trees were 15 ft. in height, with trunks 5 to 6 in. and even 1 ft. in diameter, a quite exceptional size for *Myricaria*.

1. **M. germanica**, Desv.; Fl. Br. Ind. i. 250; Brandis For. Fl. 23, t. 8. Vern. *Bis*, *shalakát*, *kathi*, *humbu*, Pb.; *Ombu*, Lahoul.

A shrub with rough brownish *bark*. *Wood* hard, white. *Annual rings* marked by porous spring wood. *Pores* small. *Medullary rays* broad, short, very numerous and prominent.

Inner Himalaya from the Punjab to Sikkim, at from 10–14,000 ft.
This shrub is very common along the rivers in the inner Himalaya, and often

affords almost the only woody vegetation. The wood is used for fuel, and the branches as fodder for sheep and goats.

		lbs.
H 133.	Lahoul, 10,000 ft. (Heyde)	—
E 974.	Chumbi Valley, Tibet, 10,000 ft. (Schlich)	—

Nordlinger's Sections, vol. 6 (*Tamarix germanica*, Linn.).

ORDER XIV. HYPERICINEÆ.

A small Order of two Tribes, each of a single genus.

Tribe I. Hypericeæ	Hypericum.
„ II. Cratoxyleæ	Cratoxylon.

1. HYPERICUM, Linn.

St. John's Worts. Small shrubs or herbs, of small importance, but with showy yellow flowers. *H. cernuum*, Roxb. Fl. Ind. iii. 400; Fl. Br. Ind. i. 253; Vern. *Pinguiaro, phiunli*, Jaunsar; *Piuli*, Malkot, is a small, pretty, large-flowered shrub common in the North-West Himalaya at from 5–7000 ft., chiefly on rocks. *H. Hookerianum*, W. and A.; Fl. Br. Ind. i. 254; Gamble Darj. List 7, is a tall shrub of the Sikkim Himalaya, Khasia Hills, and Nilgiris, with handsome golden flowers, well worthy, like *H. cernuum*, of cultivation. The rest, except those given below, are quite unimportant.

1. **H. mysorense**, Heyne; Fl. Br. Ind. i. 453.

A handsome large shrub. *Bark* brown, thin, cleft both vertically and horizontally into small rectangular plates. *Wood* white with an orange-red heartwood, hard, close- and even-grained, smooth. *Pores* very small, numerous. *Medullary rays* very fine, extremely numerous.

Hills of S. India from the Konkan to the Pulneys, also Ceylon at 5–8000 ft.; common on open grassy land, and very conspicuous.

W 3746. Coonoor, Nilgiris, 6000 ft. (Gamble).
W 4185. Rallia, Nilgiris, 6500 ft. „

2. **H. patulum**, Thunb.; Fl. Br. Ind. i. 254; Gamble Darj. List 7. Vern. *Tumbomri, sung ryong*, Lepcha.

A handsome shrub. *Bark* brown, branchlets red. *Wood* white, close-grained, moderately hard. *Pores* very small, scanty. *Medullary rays* fine, very numerous. *Annual rings* marked by a ring of larger pores than those in the rest of the wood.

Himalaya from Chumba to Bhutan, at from 5–8000 ft.; Khasia Hills; Kachin Hills in Upper Burma. Very common about Darjeeling on open hill-sides; sometimes used for hedges.

		lbs.
E 2861.	Darjeeling, 7000 ft. (Gamble)	43

2. CRATOXYLON, Bl.

Five species of trees or shrubs of Burma or the Andaman Islands. *C. polyanthum*, Korth.; Fl. Br. Ind. i. 257, and *C. prunifolium*, Dyer Fl. Br. Ind. i. 258 (*C. pruniflorum*, Kurz For. Fl. i. 84), are trees of the Eng and other forests from Martaban to Tenasserim and the Andamans. *C. arborescens*, Bl.; Fl. Br. Ind. i. 258, is a large shrub of Tenasserim. *C. formosum*, Bth. and Hook. f.; Fl. Br. Ind. i. 258; Kurz i. 85, is a pretty tree, rather rare in open places of the tropical forests of S. Andaman; cultivated in Calcutta.

1. **C. neriifolium,** Kurz For. Fl. i. 85; Fl. Br. Ind. i. 257. Vern. *Bébya,* Burm.

A tree. *Bark* dark-coloured, rough. *Wood* dark grey, hard, close-grained. *Pores* large, in short narrow wavy irregular patches of loose tissue. *Medullary rays* not prominent, fine, numerous, on a radial section visible as a silver-grain of dark narrow plates.

Chittagong and Burma, in the drier upper hill forests.

Weight, 47 lbs. per cubic foot. According to Kurz, the wood is used for building purposes, for ploughs, handles of chisels, hammers, and other implements. In the Mandalay District it is considered a good fuel (J. W. Oliver).

		lbs.
B 312.	Burma (1867)	47

ORDER XV. GUTTIFERÆ.

An important Order of tropical trees, some of them of great value as timber-yielders, some as giving the valuable pigment called "gamboge," some as fruit-trees, and almost all as possessing beautiful flowers and foliage. There are 6 Indian genera, belonging to two tribes, viz.—

Tribe I. Garcinieæ . . .	Garcinia, Ochrocarpus.
,, II. Calophylleæ. . .	Calophyllum, Kayea, Mesua, Pœciloneuron.

Since the publication of the "Flora of British India," other works, such as Kurz' "Forest Flora of British Burma," Trimen's "Ceylon Handbook," King's "Materials for a Flora of the Malay Peninsula," Hooker's "Observations on Some Species of Garcinia" (*Journ. Linn. Soc.*, xiv. 484), and finally the Monograph of the Guttiferæ by J. Vesque, which forms vol. 8 of De Candolle's "Monographiæ Phanerogamarum," 1894, have appeared; and, after consideration, it seems best to adopt the species as given in the last-mentioned, and in the order given, as far as possible.

Wood usually reddish, generally with a distinct heartwood, and marked by characteristic faint concentric lines, which are often interrupted. *Pores* variable in size, usually rather large, single or in more or less oblique wavy lines. *Medullary rays* fine or very fine, clearly marked.

TRIBE I. GARCINIEÆ.

1. GARCINIA, Linn.

A large genus of evergreen, opposite-leaved trees, usually with a yellow juice, generally giving a more or less useful description of gamboge. They are almost entirely tropical trees, none extending to the Punjab or North-West Provinces and very few even to the North-East Himalaya. The Genus is subdivided into two Subgenera, XANTHOCHYMUS with 5, and EUGARCINIA with 31 species.

Wood moderately hard or hard, close-grained, yellowish-white, red or grey, with numerous and characteristic wavy bands of loose texture. *Pores* scanty, small to large. *Medullary rays* usually fine.

The following extract from an official report, obtained from the *Madras Mail* of Nov. 17, 1885, will explain the value of the species of *Garcinia* as gamboge-yielders:—

"The Collector of Malabar reports that there are four species of Garcinia indigenous 'in the forests of his district. (1) *Garcinia Morella* grows on the Peria ghât in the 'extreme north-west portion of the Wynaad taluq, up to an elevation of about 1500 ft. 'This species yields the tree gamboge of commerce. There is a considerable export 'from Ceylon, but none from the district. (2) *Garcinia pictoria* is widely distributed 'and is found growing along the slopes of the Western Ghâts, from 1–4000 ft. elevation 'It is very abundant in the Chenat Nair forests, and fairly common everywhere. I

'yields an excellent pigment, samples of which were sent to the International Forestry 'Exhibition, Edinburgh, last year; also to the Calcutta Exhibition. The gamboge is 'collected by lightly scraping the moss and the old bark of the stems of the trees, and 'then pricking them all over, with an instrument resembling a hair-brush, with wire 'nails fixed in it at intervals of ¼ inch apart. The work should be done from December 'to March, when there is no rain. The gamboge collects in little tears, about the size 'of a small pea, in from three to four days, and is quite hard in a week, when it can be 'collected. The cost of collection amounts to about Rs.1 8*a*. per pound, which is as 'much as the product is worth in the London market, hence there is no trade in it here. 'A second way of collecting the gamboge is to clean the bark of the trees of all extraneous 'matter, and then to strip it off, pound and boil it. A yellow extract is thus obtained, 'which when inspissated yields a golden-brown gamboge of inferior quality worth about '6*d*. a pound. The stripping of the bark, of course, kills the tree. The method is, 'therefore, a wasteful and expensive one. The fruits of both species are rich in gamboge, 'and the seeds yield an oil. (3) *Garcinia Xanthochymus*. This species is indigenous 'to the ghát forests above Karimpoya, in Nilambur. It bears a large golden-coloured, 'thin-skinned edible fruit of a pleasant sub-acid flavour, in bunches of 3 or 4 together. 'It is cultivated at Calicut and in the Wynaad, and is a tree of exceedingly slow growth. 'The gamboge yielded by it is resinous, and worthless as a pigment. (4) *Garcinia 'Cambogia*. A very common tree on the Western Ghâts, up to 4500 feet, where, how-'ever, it rarely exceeds 20 ft. in height. It yields a translucid resinous gamboge useless 'as a pigment. The fruit is ribbed, and of a bright canary colour. The aril is edible, 'being of a pleasant sub-acid like the mangosteen. The rind of the fruit when green is 'intensely acid, and is used by the Kurumbers and other wild tribes as a substitute for 'tamarind in their curries. The seeds yield an oil. (5) *Garcinia purpurea*.—A very 'rare tree on the ghâts, but cultivated at Calicut for the sake of its edible fruit, which 'is of a bright purple colour. It yields a gamboge which might be used as a pigment. '*Garcinias travancorica* and *Wightii* are both said to yield excellent pigments, but they 'do not occur in this district. The Collector of the Nilgiris reports that the *Garcinia 'pictoria* does not grow in his district."

SUBGENUS I. XANTHOCHYMUS.

Five species. *G. malabarica*, Talbot in Journ. Bomb. Nat. Hist. Soc. xi. 234 (*G. ovalifolia*, Hook. f. var. *macrantha*; Fl. Br. Ind. i. 269), is a small or moderate-sized tree of the Western Ghâts, common in evergreen forests about Gairsoppa. *G. andamanica*, King Journ. As. Soc. Beng. lix. 170 (*G. dulcis*, Kurz For. Fl. i. 92), is an evergreen tree of the Andaman Islands.

1. **G. spicata**, Hook. f.; Trimen Fl. Ceyl. i. 98. *G. ovalifolia*, Hook. f.; Fl. Br. Ind. i. 269; Talbot Bomb. List 15. *Xanthochymus ovalifolius*, Roxb. Fl. Ind. ii. 632; Bedd. Fl. Sylv. xxi. Vern. *Baldi*, Mar.; *Kokottai*, Tam.; *Elagokatu, gonapana*, Cingh.

A small or medium-sized evergreen tree. *Bark* thick, smooth, olive-green or brownish, wrinkled in horizontal folds. *Wood* yellowish-white, hard, close-grained, with numerous concentric white bands which are slightly wavy and occasionally broken. *Pores* scanty, moderate-sized. *Medullary rays* fine, numerous, long, making a pretty silver-grain.

Forests of both coasts of the Western Peninsula: on the west, in the Konkan, Kanara, Malabar and Travancore in evergreen forests; on the east, in the Northern Circars and Carnatic, common in Striharikota forest; Ceylon, in the dry region, common about Jaffna.

		lbs.
W 4727.	Travancore (Bourdillon)	59
D 4257.	Striharikota, Nellore (Brougham)	61

2. **G. Xanthochymus**, Hook. f.; Fl. Br. Ind. i. 269; Kurz For. Fl. i. 93; Talbot Bomb. List 15. *Xanthochymus pictorius*, Roxb. Fl. Ind. ii. 633; Bedd. Fl. Sylv. t. 88. Vern. *Tepor*, Ass.; *Maoshla*, Phekial; *Dampel*, Hind.; *Tamál*, Beng.;

Mukki, Tam.; *Iwara memadi, tamalamu, chitakamraku*, Tel.; *Divarige, janagi, deavkai*, Kan.; *Ana-váya*, Trav. Hills; *Madaw*, Burm.

A medium-sized evergreen tree. *Bark* brown, ¼ in. thick, exfoliating in small round scales. *Wood* dark greyish-brown, very hard and close-grained; concentric bands thin, white, numerous. *Pores* very scanty, moderate-sized, scattered and unevenly distributed. *Medullary rays* fine, white, numerous but irregular.

Eastern Himalaya and E. Bengal; Western Coast from Kanara southwards through Coorg and Nilgiris; Eastern Coast in the N. Circars; throughout Burma; Andaman Islands.

The wood is strong and good, but apparently not used. The yellow gum is copious, but apparently useless as gamboge. The fruit is yellow, about the size of a small apple, and very acid; it is sometimes used like the fruit of *G. indica*, by drying the pulp in the sun, when it is eaten in curries or used in medicine (see Pharmacogr. Ind. i. 166). (Vern. *Amsúl, kokam, onth, osht.*) The bark is used as a dye in Assam.

		lbs.
C 3826.	Mahendragiri, Ganjam, 4000 ft. (Gamble)	57

3. G. Imberti, Bourdillon in Journ. Bomb. Nat. Hist. Soc. xii. 349.

A moderate-sized tree. *Bark* brown and white, smooth, ¼ in. thick. *Wood* yellowish-grey, hard, with very numerous regular, pale, close, wavy concentric lines of loose texture. *Pores* small, scanty. *Medullary rays* fine, white, irregular.

Evergreen forests of S. Travancore, above 3000 ft.

		lbs.
W 4691.	Travancore (Bourdillon)	56, P = 685

SUBGENUS II. EUGARCINIA.

The species are grouped by Vesque in four sections.

Section 1. *Mangostana.* About 16 species.

G. merguensis, Wight; Fl. Br. Ind. i. 267; Kurz For. Fl. i. 89, is an evergreen tree of Tenasserim; and *G. eugeniæfolia*, Wall.; Fl. Br. Ind. i. 268, is also found there and in the Andamans. In the Andaman Islands also occur *G. Lanessanii*, Pierre; Vesque Monog. 358 (*G. Cadelliana*, King), a tree; *G. Kurzii*, Pierre, a shrub; and *G. Kingii*, Pierre, apparently also a shrub. In the Nicobar Islands is found *G. Hombroniana*, Pierre, a tree with quadrangular branchlets. In Eastern Bengal there are 5 species. *G. pedunculata*, Roxb. Fl. Ind. ii. 625; Fl. Br. Ind. i. 264; Gamble Darj. List 7; Vern. *Tikúl, tikúr*, Beng.; *Bor tekera*, Ass., is a tree of Rungpore, Goalpara and Sylhet, with a large fruit, weighing, according to Roxburgh, 2 lbs., of a yellow colour and very acid. Roxburgh recommended its being dried and preserved as a substitute for limes. The tree is often cultivated, and the wood is "used for planks, 'beams and ordinary building" (Mann). *G. anomala*, Pl. and Trian.; Fl. Br. Ind. i. 266; Kurz For. Fl. i. 89; Vern. *Usaqueng*, Ass., is a small tree of the Khasia and Jaintia Hills and the hills of Martaban in Burma at 3–6000 ft. *G. Keeniana*, Pierre is a tree of Cachar. *G. affinis*, Wall. (*G. cornea*, Chois.; Fl. Br. Ind. i. 260; Kurz For. Fl. i. 88), is a small tree of Sylhet. *G. atroviridis*, Griff.; Fl. Br. Ind. i. 266, is found at Tabong in Upper Assam.

4. G. terpnophylla, Thw.; Fl. Br. Ind. i. 268; Bedd. Fl. Sylv. xxi.; Trimen Fl. Ceyl. i. 97. Vern. *Kokatiya*, Cingh.

A small tree. *Bark* greyish-brown, very smooth. *Wood* hard, close-grained, deep orange-brown streaked with yellow; with prominent regular concentric pale bands. *Pores* moderate-sized to large, very scanty, prominent on a vertical section. *Medullary rays* numerous, moderately broad.

Low country of Ceylon and up to 4000 ft.

This is a beautiful wood, which deserves to be better known, unless by some chance or other Mendis has made a mistake. The structure of his specimen, however, agrees with *Garcinia*, and I see no reason to doubt it. Beddome speaks of the wood as weighing 58 to 60 lbs. per cubic foot, and as well adapted for bridge building and framing, easily worked, but unsuited to joinery because apt to split.

	lbs.
Ceylon Collection (new), No. 76 (Mendis)	56

5. G. stipulata, G. And.; Fl. Br. Ind. i. 267; Gamble Darj. List 7. Vern. *Sanakadan*, Lepcha.

A tree with brown bark. *Wood* light orange-yellow, moderately hard, close-grained. *Pores* moderate-sized, sometimes subdivided. *Medullary rays* moderately broad, numerous. Numerous wavy concentric bands of soft texture, and of colour lighter than the rest of the wood, often anastomozing.

Sikkim and Bhutan in damp forests up to 4000 ft.

The fruit is yellow and sometimes eaten by Lepchas. It gives a yellow gum, chiefly from the fruit, but it does not seem to be used.

E 3352. Kalimpúng, Darjeeling, 4000 ft. (Gamble).

6. G. travancorica, Bedd. Fl. Sylv. t. 173; Fl. Br. Ind. i. 268. *Garcinia* sp. No. 2 in Bedd. Fl. Sylv. xxi. Vern. *Malampongu*, Tinnevelly.

A large tree. *Wood* yellowish-brown, sapwood pale yellow, hard, heavy, close-grained. *Pores* small, in wavy somewhat concentric anastomozing lines. *Medullary rays* fine to moderately broad, long, numerous, showing a pretty silver-grain on a radial section. *Annual rings* not prominent.

Ghát Forests of Travancore and Tinnevelly, at 3–5000 ft.

Beddome says, "Every portion of the tree yields an abundance of bright yellow gamboge, not yet examined." Apparently no information has since become available.

	lbs.
W 4693. Travancore (Bourdillon).	49

7. G. Mangostana, Linn.; Roxb. Fl. Ind. ii. 618; Fl. Br. Ind. i. 260; Kurz For. Fl. i. 87. The Mangosteen. Vern. *Mangustán*, Hind., Beng.; *Mingut*, Burm.

An evergreen tree. *Bark* dark brown or almost charcoal-black, inner bark yellowish. *Wood* brick-red, hard. *Pores* moderate-sized, scanty, single or in small groups surrounded by loose tissue, the groups very irregularly run together into more or less concentric patches, sometimes long and continuous, more often subdivided. *Medullary rays* moderately broad, not very numerous, of the same colour as the patches.

Malay Peninsula (doubtfully wild); cultivated in Tenasserim and in special localities in India, as at Barliyár in the Nilgiri Hills.

This is the tree that yields the Mangosteen fruit, considered by many as the finest fruit of the Eastern tropics. Helfer says that one tree may yield 1000 fruits yearly, valued at Rs.3 per 100, and one tree at Barliyár has been said to yield 1200 fruits. The rind of the fruit is used in tanning and as a medicine. For successful cultivation a very hot and moist and uniform climate is required, and it has never been successfully grown in Northern India.

Singapore—Kew Museum (Ridley).
Java— (Scheffer).

8. G. speciosa, Wall.; Fl. Br. Ind. i. 260; Kurz For. Fl. i. 88. Vern. *Payava*, Burm.

An evergreen tree. *Bark* thin, greyish-black. Heartwood red, very hard, cross- and close-grained, with numerous short, wavy, transverse bands. *Pores* small, very numerous. *Medullary rays* very fine, uniform, equidistant, not very distinct.

Tenasserim and the Andaman Islands.

Weight, according to Major Protheroe, 72 lbs.; our specimens give only 52 lbs., and Wallich (Nos. 73, 74, *Garcinia* sp., *Pullowa*) 45·5 lbs.

The wood is used for house and bridge posts, and other purposes; and it is said to be used by the Andamanese to make bows. According to Vesque, this species does not occur in the Andamans, and our tree should be *G. Kurzii*, Pierre, but he seems to have ignored King's remarks, in view of which no change is made here. Kurz clearly identifies the timber tree as *G. speciosa*.

		lbs.
B 504.	Andaman Islands (General Barwell)	52
B 2492.	„ „ (Home, 1874, No. 18)	52

Two specimens marked B 2493, *Pantagyah*, No. 20 (51 lbs.), and B 2500, *Phungnyet*, No. 19 (62 lbs.), brought by Home from the Andamans in 1874, resemble *G. speciosa*, but the pores are in short radial lines and the medullary rays more distinct.

B 2206 (47 lbs.), received from the Andamans in 1866 under the name of *Thinganee*, is similar in structure to B 2493 and 2500, but the pores are larger.

These specimens probably belong to one of the other Andaman tree Garcinias, *G. Kingii*, Pierre, or *G. Lanessani*, Pierre.

Section 2. *Cambogia*. Six species.

G. lanceæfolia, Roxb. Fl. Ind. ii. 623; Fl. Br. Ind. i. 263; Kurz For. Fl. i. 91; Vern. *Kan tekera*, Ass.; *Kirindur*, Sylhet, is a small tree of the forests of Assam, Sylhet, the Chittagong Hills and the Kachin Hills of Burma. *G. microstigma*, Kurz For. Fl. i. 91, is a shrub of South Andaman.

9. G. paniculata, Roxb. Fl. Ind. ii. 626; Fl. Br. Ind. i. 266; Kurz For. Fl. i. 92. Vern. *Búbi-kowa*, Sylhet.

An evergreen tree. *Bark* very thin, grey, peeling off in small thin flakes. *Wood* reddish-grey, moderately hard; with very minute closely-packed pale concentric bands. *Pores* moderate-sized, scanty. *Medullary rays* fine to moderately-broad, not numerous.

Eastern Himalaya, Khasia Hills, Sylhet and Chittagong, up to 3000 ft.

Fruit edible, resembles the mangosteen. I do not feel very certain of the identification of the specimen.

		lbs.
E 4882.	Sylhet (Babu Kripa Nath Dé)	39

10. G. echinocarpa, Thw.; Fl. Br. Ind. i. 264; Bedd. Fl. Sylv. xxi.; Trimen Fl. Ceyl. i. 96. Vern. *Pura*, Trav. Hills; *Madol*, Cingh.

A tree, 40 to 50 ft. high. *Wood* dark red, hard, heavy. *Pores* moderate-sized, in more or less concentric bands of soft texture and light colour. *Medullary rays* fine to moderately broad, not numerous, showing a marked silver-grain.

Moist region of Ceylon, 1–6000 ft.; Travancore, in evergreen forests 2–4000 ft.

"Easily recognized by its numerous aërial roots, which are copiously produced 'from the lower part of the stem, as in the mangroves" (Trimen). "Wood largely used 'for shingles in Ceylon" (A. F. Broun). The seeds give an oil which is used for burning.

		lbs.
W 4692.	Travancore (Bourdillon)	51

11. G. indica, Chois.; Fl. Br. Ind. i. 261; Talbot Bomb. List 15. *G. purpurea*, Roxb. Fl. Ind. ii. 624; Bedd. Fl. Sylv. xxi. Vern. *Brindall*, Goa; *Murgal*, Kan.; *Bhairnd, ratamba*, Mar.; *Kokum*, Hind.

A slender tree with drooping branches. *Bark* light brown, rather shiny, very thin, smooth. *Wood* greyish-white, hard; many dark concentric lines, resembling annual rings, without or with very few pores; very numerous, wavy, narrow, anastomozing white bands, in which the few scanty moderate-sized *pores* appear. *Medullary rays* moderately broad, white, regular.

Western India, forests of the Konkan, Kanara, Coorg and Wynaad; often planted.

Fruit the size of a small orange, purple, edible, sometimes called "Wild mangosteen." An oil, called "Kokam butter," is obtained from the seeds and used for food and as a medicine (see also Watt Dict. Econ. Products, vol. iii. 467).

		lbs.
W 4303.	S. Kanara (Peake)	49

12. G. Cambogia, Desr.; Fl. Br. Ind. i. 261; Roxb. Fl. Ind. ii. 621; Bedd. Fl. Sylv. t. 85; Talbot Bomb. List 15; Trimen Fl. Ceyl. i. 95. *G. conicarpa*, Wight; Bedd. Fl. Sylv. xxi. Vern. *Aradal, upagi mara, manthulli*, Kan.; *Heela*, Badaga; *Korakkaipuli*, Tam.; *Kodapuli, pinara*, Mal.; *Goraka*, Cingh.

A small evergreen tree. *Wood* grey, sometimes patched with red, shining, hard, close-grained, smooth; concentric bands forming transverse bars, very numerous, white and prominent. *Pores* small and very small, in short radial lines, between the closely packed, uniform, fine *medullary rays*.

Western Coast and Ceylon, ascending to 6000 ft. on the Nilgiris.

Beddome says the wood would answer for common furniture. Bourdillon gives the weight at 47 lbs., P = 608.

Thwaites states that this tree yields a yellow insoluble gum, which is consequently valueless as a pigment. It is, however, said to be soluble in spirits of turpentine, and to form a beautiful yellow varnish. Mr. Cherry says it gives an oil which is used in medicine. "The fruit is eaten; it is of a pleasant acid taste" (A. F. Broun). The rind of the fruit is acid, and is said to be used by Kurumbers as a substitute for tamarind in their curries.

		lbs.
W 845.	South Kanara (Cherry)	54
W 4625.	Travancore (Bourdillon)	46

Section 3. *Oxycarpus.* Two species.

G. succifolia, Kurz For. Fl. i. 91 (*G. loniceroides*, T. And.; Fl. Br. Ind. i. 264), s an evergreen tree of the swamp forests of the Irrawaddy and Sittang deltas.

13. G. Cowa, Roxb. Fl. Ind. ii. 622; Fl. Br. Ind. i. 262; Kurz For. Fl. i. 90. *G. Kydia*, Roxb. Fl. Ind. ii. 623; Kurz For. Fl. i. 90. Vern. *Cowa*, Hind.; *Taungthalé*, Burm.

A tall evergreen tree with round stem. *Bark* dark grey. *Wood* greyish-white, moderately hard, with many wavy, fine, concentric bands of soft tissue. *Pores* moderate-sized to large, scanty, often subdivided. *Medullary rays* fine to broad, short.

Eastern Bengal, Assam, Chittagong, Burma and the Andaman Islands.

Weight, 42 lbs. per cubic foot (Brandis, 1862, No. 19, also Kurz); our specimens give an average of 40 lbs. Kyd gives weight 47 lbs., P = 815. Wood not used. Is said to give a kind of gamboge of a rather different colour to that produced by *G. Morella*, insoluble in water, but soluble in turpentine, and so affording an excellent yellow varnish.

		lbs.
B. 549.	Martaban (Seaton)	43
B 3148.	Burma (Brandis, 1862)	37
	Nordlinger's Sections, vol. 4.	

Section 4. *Hebradendron*. Seven species.

G. Choisyana, Wall.; Fl. Br. Ind. i. 265, is a tree of Tavoy. *G. heterandra*, Wall.; Fl. Br. Ind. i. 265. (*G. elliptica*, Wall.; Kurz For. Fl. i. 92); Vern. *Thanattaw*, Burm., is a tree of the hills of Burma up to 3000 ft., said by Kurz to have a soft white wood and to give a superior quality of gamboge. A sample obtained from Tavoy and analyzed gave: resin 76·5 per cent., gum 23·5, so that it is only partially soluble (R. A. Mack, cf. Ind. For. xi. 392, 1885). *G. pictoria*, Roxb. Fl. Ind. ii. 627; Bedd. Fl. Sylv. t. 87 (*G. Morella*, Desr.; Fl. Br. Ind. i. 264, *part*), is a tree of the Western Ghâts, especially Kanara and Malabar, from 1–4000 ft., and abundant in the Chenat Nair forests. It gives an excellent gamboge, which is obtained either by scraping off the dead outer bark and then pricking the stem and collecting the small tears which exude, or by stripping the bark, pounding it, and boiling.

G. calycina, Kurz, is a tree of the Nicobar Islands. *G. elliptica*, Hook. f. and Th., is a tree of the Khasia Hills, Sylhet and Eastern Bengal.

14. G. Morella, Desr.; Fl. Br. Ind. i. 264; Bedd. Fl. Sylv. t. 86; Talbot Bomb. List 15; Trimen Fl. Ceyl. i. 96. The Gamboge tree. Vern. *Aradal, arsina gurgi, hardala, punar puli, kankutake*, Kan.; *Kana-goraka*, Cingh. The gum resin, *Gota gamba*, Hind.; *Makki*, Tam.; *Revachinni*, Mar.; *Chigiri*, Trav. Hills; *Gokatû*, Cingh.

An evergreen tree. *Wood* yellow, hard, mottled, with numerous, wavy, concentric bands of soft texture. *Pores* large, subdivided. *Medullary rays* moderately broad.

Forests of the Khasia Hills, Eastern Bengal, Western Coast and Ceylon.

The tree which produces the true gamboge. The gum is, however, not collected in the forests of South India, and the chief trade supply is obtained from Siam. Whether it would not be advisable to do more with the Indian gum and to cheapen its cost of production by growing it in regular plantations in suitable places in Kanara and Malabar, is well worth consideration. In Ceylon it is usually collected by cutting a thin slice off the bark of the tree here and there of the size of the palm of the hand. On the flat space thus exposed the gum collects, and is scraped off when sufficiently dried.

	lbs.
No. 14, Ceylon Collection, old (marked *Cambogia Gutta*, Vern. *Cocatiye*)	56

E 3365 is a specimen of the wood of a *Garcinia* from Burkhal, Chittagong Hill Tracts. *Bark* thin, brown. *Wood* reddish-white, moderately hard. *Pores* large, scanty, often subdivided. *Medullary rays* fine to broad. Numerous, wavy, concentric bands of soft tissue across the rays. It may belong to *G. elliptica*.

15. G. Wightii, T. And.; Fl. Br. Ind. i. 265. Vern. *Puli maranga*, Mal.; *Koli-vála*, Trav. Hills.

A small tree (?). *Wood* white, hard, close-grained, with narrow concentric wavy anastomozing bands of light tissue. *Pores* small. *Medullary rays* fine to moderately broad, long, rather scanty.

Forests of Southern India; in Travancore on river-banks up to 500 feet.

The gamboge of this species is very soluble and yields a good pigment (T. Anderson).

	lbs.
W. 4724. Travancore (Bourdillon)	59

2. OCHROCARPUS, Thouars.

Two species.

1. O. longifolius, Bth. and Hook. f.; Fl. Br. Ind. i. 270; Bedd. Fl. Sylv. t. 89; Talbot Bomb. List 15. Vern. *Chhuriana*, Uriya; *Suringi*, Mar.; *Sura-ponna*, Tel.; *Wundi, punay, surungi, suragi, gardúndi*, Kan.

A large evergreen tree. *Bark* reddish-brown, ½ inch thick, exuding a red gum. *Wood* red, hard, close- and even-grained. *Pores*

moderate-sized. *Medullary rays* moderately broad, very numerous, the distance between them equal to, or less than, the diameter of the pores. *Annual rings* marked by a dark line. Lines of soft texture numerous, but indistinct. Numerous resin-ducts in radial long cells, which appear as shining lines on a horizontal, and black points on a vertical section.

Western India from Bombay through the Konkan and N. Kanara to Malabar. Cultivated in Orissa and the N. Circars and elsewhere.

A handsome tree. The small forest of Kohori near Khurdha in Orissa is interesting. It was planted on an area of about 12 acres by a former Raja of Khurdha, and was thriving well in 1880. Beddome says the flower-buds are used for dyeing silk. Skinner, No. 35 (*Calophyllum longifolium*, Wall.), gives weight 45 lbs., P = 546. Growth in Orissa moderate, 8 rings per inch of radius. The flower-buds are used to dye silk (T. Cooke).

	lbs.
C 3513, 3524. Kohori, Khurdha, Orissa (Gamble)	55

2. O. siamensis, T. And.; Fl. Br. Ind. i. 270; Kurz For. Fl. i. 94 (also *O. nervosus*, Kurz For. Fl. i. 94 according to Vesque). Vern. *Talapi*, Burm.

An evergreen tree. *Bark* brown, ¼ inch thick, with prominent lenticels. *Wood* dark red, hard, close- and even-grained. *Annual rings* marked by a dark line. *Pores* moderate-sized, very scanty, unevenly distributed. *Medullary rays* fine to moderately broad, numerous, causing a neat silver-grain. Resin-ducts as in *O. longifolius.*

Burma, in the Pyinmana and Prome Hills, the Arracan Yoma and the Eng forests of Martaban.

An excellent wood, but the growth of the tree is apparently slow, about 15 to 16 rings per inch.

	lbs.
B 4849. Pyinmana, Burma (G. E. Cubitt)	61

Tribe II. CALOPHYLLEÆ.

3. CALOPHYLLUM, Linn.

A large genus of chiefly tropical trees, of which many species occur in the Malay Peninsula and Ceylon. They are all remarkable for handsome flowers and beautiful parallel-veined, opposite, coriaceous leaves.

Wood soft or moderately hard, reddish, with a darker-coloured heartwood, seasons well, weight moderate. *Cellular tissue* regular, cells roughly rectangular. *Pores* moderate-sized or large, prominent on a vertical section, arranged in wavy strings or groups. *Medullary rays* fine or very fine, indistinct on a cross-section, but prominent as straight narrow lines on a radial section. Interrupted concentric lines of darker colour and larger cells, also prominent on a vertical section. *Wood* very characteristic.

Of the 14 species, 8 are endemic in Ceylon, one common to Ceylon and S. India, another to Ceylon and the Andamans. One species is found only in Northern and Eastern Bengal, one in S. India, and one in Burma and the Andamans, while one only, the most common, has anything like a wide range. *C. bracteatum*, Thw.; Fl. Br. Ind. i. 274; Bedd. Fl. Sylv. xxii.; Trimen Fl. Ceyl. i. 102; Vern. *Walu-kina*, Cingh., is a large tree, endemic in the low country of Ceylon, and remarkable for the leaves when young being white and flaccid, and hanging down perpendicularly like those of *Amherstia* and other Leguminosæ. *C. Walkeri*, Wight; Fl. Br. Ind. i. 275;

Bedd. Fl. Sylv. xxii.; Trimen Fl. Ceyl. i. 104; Vern. *Kina*, Cingh., is a beautiful round-headed large tree of the hill country of Ceylon, endemic and giving its character to the forests. It is common and conspicuous about Newera Ellia, where some individuals of very large size may be seen at about 6–8000 ft. Trimen says that the wood is "pale reddish-brown, hard, rather light, durable." It is used for shingles. The fruit gives an oil used for lighting and in medicine. *C. amœnum*, Wall., Kurz For. Fl. i. 95, is a tree of Tenasserim and the Andamans.

1. **C. inophyllum**, Linn.; Fl. Br. Ind. i. 273; Roxb. Fl. Ind. ii. 606; Bedd. Fl. Sylv. xxii.; Kurz For. Fl. i. 95; Talbot Bomb. List 15; Trimen Fl. Ceyl. i. 100. The Alexandrian Laurel. Vern. *Sultana champa*, Hind., Beng.; *Pinnay*, *punnai*, Tam.: *Poonang*, Uriya; *Undi*, Mar.; *Wúma*, *hona*, *pinekai*, Kan.; *Púna*, *púnás*, Tel.; *Domba*, *tel-domba*, Cingh.; *Pōnnyet*, Burm.; *Bintangor*, Malay.

An evergreen tree. *Bark* grey or blackish-brown, smooth. *Wood* reddish-brown, moderately hard, close-grained. *Pores* moderate-sized, arranged in groups or oblique strings. *Medullary rays* extremely fine and numerous, bent round the pores. Occasional interrupted concentric lines of darker but softer tissue, prominent on all sections.

Coast of South India from the Konkan and Orissa southwards; Burma, and the Andaman Islands; Ceylon; often cultivated for ornament in other parts.

A beautiful tree with a round fruit from which an oil is extracted and used for burning. The wood is said by Beddome to be "valuable for some purposes in ship-building," and by Kurz to be "good for masts, spars, railway-sleepers, machinery, etc." Mendis says it is used for the masts and spars of dhonies and fishing-boats. Sebert, in "Les bois de la Nouvelle Calédonie," says that it is a magnificent wood for cabinet-maker's work, and that it gives a yellowish-green, pleasantly scented resin. He gives the weight at about 59 lbs. per cubic foot, Kurz says 63 lbs., but the specimens average only 42 lbs., omitting the last, which was rather decayed. In the Andamans it gives squares up to 25 ft., siding 1 ft. 6 in.

	lbs.
W 733. South Kanara (Cherry)	38
B 2257, 2258, 2263. Andaman Islands (Col. Ford, 1866)	45, 44, and 26
No. 26, Ceylon Collection, new (Mendis)	40
Nordlinger's Sections, vol. 9 (Tab. 1. 4).	

2. **C. tomentosum**, Wight; Fl. Br. Ind. i. 274; Bedd. Fl. Sylv. xxii.; Talbot Bomb. List 16; Trimen Fl. Ceyl. i. 101. *C. elatum*, Bedd. Fl. Sylv. t. 2. The Poon spar tree. Vern. *Poon*, *poone*, Mal.; *Pongu*, *malampunna*, Tam.; *Nagari*, Mar.; *Surhoni*, *siri*, *poone*, *kuve*, *bobbi*, Kan.; *Punnapay*, Mal.; *Viri*, Trav. Hills; *Kina*, Cingh.

A large tall evergreen tree. *Bark* with longitudinal cracks. *Wood* reddish-brown, moderately hard, streaked on the vertical sections by the dark concentric lines and the pores. *Pores* large, scanty, in oblique strings. *Medullary rays* fine, very numerous, bent round the pores. Concentric lines long or short, interrupted, dark.

Evergreen forests of the Western coast from N. Kanara to Travancore, ascending to 5000 ft.; moist country of Ceylon at 2–4000 ft.

The tree yields the poon spars of commerce, but the spars are now in but small demand, though Beddome says that some years ago a single spar has fetched as much as Rs.1000. Cleghorn, writing in 1858, complained of the use of poon for bridge work, and commented on the wood becoming scarce ("Forests and Gardens of S. India," p. 11), so that in his time the spars must have been valuable. More information is badly wanted on the subject of the mast trade. The wood is now in use for building and bridge work. Couch's experiments at Plymouth dockyard gave the weight 36 to 43 lbs. per cubic foot; the specimens give 36 lbs.; Molesworth, in "Graphic Diagrams for Strength of Teak Beams," gives weight 37 lbs., P = 640, E = 3500. The seeds give an orange-coloured oil, probably used for burning. The tree also affords a black opaque

gum, apparently but little used. Bourdillon says the rate of growth is rapid, 2 to 4 rings per inch of radius.

		lbs.
W 762.	S. Kanara Forests (Cherry)	32
D 1279.	Anamalai Hills, Coimbatore (Beddome)	38
W 4145.	Malabar Forests (Morgan)	38

Nordlinger's Sections, vol. 10.

3. C. polyanthum, Wall.; Fl. Br. Ind. i. 274; Kurz For. Fl. i. 95; Gamble Darj. List 7. Vern. *Kandeb*, Beng.; *Kironli*, Nep.; *Sunglyer*, Lepcha; *Kraidone*, Magh.

An evergreen tree. *Wood* red-brown, moderately hard, in structure similar to that of the other species.

Northern and Eastern Bengal, Khasia Hills, Chittagong forests, and damp hill forests of Martaban, up to 5000 ft.

An excellent wood, strong and good. Chester says it is largely used in Chittagong for masts, spars, rafters, and sometimes for building boats and canoes. The Darjeeling specimens have a darker colour than the others. Weight 41 lbs. per cubic foot.

		lbs.
E 2490.	Chenga Forest, Darjeeling Terai (Gamble)	38
E 2953.	Chunbati, Darjeeling, 3000 ft. ,,	39
E 1400.	Chittagong Hill Tracts (Chester)	44
E 3692.	Chittagong Hill Tracts (Gamble)	41

4. C. Wightianum, Wall.; Fl. Br. Ind. i. 274; Bedd. Fl. Sylv. t. 90; Talbot Bomb. List 16. Vern. *Bobbi*, Mar.; *Irai*, *kalpoon*, *kull-ponne*, Kan.; *Sirapunna*, *cheru pinnay*, Tam.; *Purapunna*, Mal.

An evergreen tree. *Bark* yellow, very characteristic. *Wood* hard, red. *Pores* large and moderate-sized, uniformly distributed. *Medullary rays* very fine, not very distinct. Numerous interrupted, wavy and anastomozing concentric bands of soft tissue.

Western Ghâts from the Konkan to Travancore, along river-banks.

Weight, 45 lbs. per cubic foot. It is probably No. 36 of Skinner's List (*C. spurium*), W = 39 lbs.; P = 567. Bourdillon gives weight 44 lbs. P = 579. Beddome says the timber is much esteemed and valuable for engineering purposes.

		lbs.
W 861.	South Kanara (Cherry)	45

5. C. Burmanni, Wight; Fl. Br. Ind. i. 272; Bedd. Fl. Sylv. xxii.; Trimen Fl. Ceyl. i. 99. Vern. *Chirupunnai*, Tam.; *Gurukina*, *hinkina*, Cingh.

A small, round-headed, much-branched tree. *Bark* thick, furrowed. *Wood* dark reddish-brown, moderately hard. *Pores* large, scanty, filled with resin. *Medullary rays* moderately broad, indefinite. Broad concentric belts of loose tissue, alternating more or less regularly with narrow darker belts.

Low country of Ceylon, on the coast and in the dry districts; common and endemic.

The wood-structure is curious and differs a good deal from that of the other Calophylla. I cannot help feeling doubtful of its authenticity. Mendis says the wood is used for bullock-cart poles and in house-building.

		lbs.
No. 42.	Ceylon Collection, new (Mendis)	44

6. C. spectabile, Willd.; Fl. Br. Ind. i. 271; Kurz For. Fl. i. 94; Trimen Fl. Ceyl. i. 99. *C. Moonii*, Wight; Bedd. Fl. Sylv. xxii. *C. amœnum*, Wall., in Paris Exhibition Catalogue, 1878. *C. tetrapetalum*, Roxb. Fl. Ind. ii. 608. Vern. *Pantaga*, Burm.; *Dakar táládá*, And.; *Lal chuni*, Hind. (from Andamans); *Domba-kina*, Cingh.

A tall evergreen tree. *Bark* smooth, yellowish-grey. *Wood* light red, shining, cross-grained, moderately hard. *Pores* large, in scattered

groups, and wavy lines prominent on a longitudinal section. *Medullary rays* fine, very numerous, prominent in the silver-grain as long, straight, dark-coloured narrow plates. Concentric lines of soft tissue, interrupted, visible on a vertical section.

Tenasserim and Andaman Islands; moist low country of Ceylon, but scarce.

Weight, 38 to 39 lbs. per cubic foot. No. 13, from the Andaman Islands, of Brandis' experiments of 1866, is probably this: Weight, 39·5 lbs., P = 530—mean of eight experiments with bars 2′ × 1″ × 1″. The wood is used for masts and spars, also for planking, for which purpose it has been employed in building barracks at the Andamans. It squares up to 25 ft., siding 18 in.

		lbs.
B 525.	Andaman Islands (General Barwell)	39
B 1992.	" " (Kurz, 1866)	38
B 3197.	" " (Home, 1874, No. 14, *Teeni*) . . .	39

No. 145, Ceylon Collection, new (Mendis), 39 lbs., is probably this species.

4. KAYEA, Wall.

Four Indian and one Ceylon species. *K. floribunda*, Wall.; Fl. Br. Ind. i. 276; Gamble Darj. List 7; Kurz For. Fl. i. 96; Vern. *Karram-jowa*, *kurun*, *kurul*, Sylhet, is a tree of the tropical forests of the Eastern Himalaya and of the hills of Martaban, ascending to 3000 ft. *K. nervosa*, T. And.; Fl. Br. Ind. i. 277; Kurz For. Fl. i. 97, is an evergreen tree of Tenasserim. *K. assamica*, King and Prain; Ind. Forester, xxvii. 62; Vern. *Sia nahor*, Ass., is a tall handsome tree of the North Lakhimpur District of Assam, recently discovered by Messrs. Barker and Young.

1. **K. stylosa,** Thw.; Fl. Br. Ind. i. 276; Bedd. Fl. Sylv. t. 102; Trimen Fl. Ceyl. i. 104. Vern. *Súvanda*, Cingh.

A large tree. *Bark* dark grey. *Wood* red, moderately hard. *Pores* moderate-sized, in radial strings, which are more or less in echelon and rather scanty. *Medullary rays* very fine, indistinct. Very fine concentric bands of soft texture across the rays.

Ceylon, south of the island.

A. Mendis gives the weight at 56 lbs. and P = 814.

	lbs.
No. 82, Ceylon Collection, old; No. 129, new (Mendis)	56

5. MESUA, Linn.

There has been much diversity of opinion regarding the limits of species in this genus. In the "Flora Sylvatica," Beddome has described, following Wight and others, six species from India and Ceylon. In the "Genera Plantarum," Bentham and Hooker admit only three, viz. the three adopted by T. Anderson in the "Flora of British India." The same view is taken by Trimen and King, but Vesque in his Monograph goes still further and admits only one species. Bourdillon (Travancore Forest Report, 1892), says, regarding Beddome's three South Indian species, "The varieties are very 'strongly marked, the *Karn-nángu*, or broad-leafed variety with small flowers and fruit, 'has the strongest timber, the *M. ferrea* of Beddome. The *Nángu*, the *M. coromandelina* 'of Beddome, has larger flowers and fruit, but small and narrow leaves; while the 'least strong is Beddome's *M. speciosa* with long leaves and large showy flowers, *Nir-'nángu*." Here it is proposed to accept the Flora of British India and consider that there are two Indian and Ceylon species.

1. **M. ferrea,** Linn.; Fl. Br. Ind. i, 277; Roxb. Fl. Ind. ii. 605; Kurz For. Fl. i. 97; Bedd. Fl. Sylv. xxiii. (with also *M. speciosa*, Choisy; *M. Roxburghii*, Wight; *M. sclerophylla*, Thw.; *M. pulchella*, Pl. and Trian., and *M. coromandelina*, Wight; Bedd. t. 64); Talbot Bomb. List 16; Trimen Fl. Ceyl. i. 105. Vern. *Nagesar*, Beng.; *Nahor*, Ass.; *Nageshvoro*, Uriya; *Nangal*, *mallay nangal*, *nángu*, *naka*, Tam.; *Naga kesara*, Tel.; *Nana*, Tinnevelly; *Nagchampa*, Mar.; *Naga-sampigi*, *kesara*,

Kan.; *Péri*, Trav. Hills; *Atha*, Coorg; *Surli*, Kader; *Behetta champagam*, Mal.; *Ná*, Cingh; *Kaing-go*, Magh.; *Naksher*, Mechi; *Gangaw*, Burm.

A large evergreen tree. *Bark* ¼ in. thick, reddish-brown, peeling off in flat thin flakes, having a slightly roughened surface. *Wood* somewhat resembling that of *Calophyllum*, but much harder and heavier. Heartwood dark red, extremely hard. *Pores* moderate-sized, scanty, often filled with yellow resin, singly or grouped, or in oblique strings of varying length. *Medullary rays* extremely fine, uniform, equidistant, very numerous. Numerous fine, wavy, concentric lines of dark-coloured tissue, regular and prominent, but of very different lengths.

Eastern Bengal from the Monas eastward (though traces of its having formerly been found west of that river occur sometimes in the names of places, *e.g.* Nageshwarbari, or Naksarbari, a town in the Sikkim Terai on the Nepal frontier); Assam; West and South India; Ceylon; Myitkyina District, Hukong Valley and Tenasserim in Burma; Andamans: often cultivated. It rises, in the hill valleys, to about 6000 ft.

A beautiful tree, formerly much planted, especially by Buddhists. Trimen mentions that it is now often planted by Buddhist temples; and S. E. Peal, writing of its frequency in Assam, where it was probably much planted in Burmese (*i.e.* Buddhist) times, says, "The forest, if properly studied, often yields information of a peculiar kind: thus the 'Nahor gives a clue to the density of population compared to what we see now. The 'large, old, and crooked branching Nahor trees clearly indicate that when young the 'country, now forest, was then open. They are often along the sides of old 'bunds' '(embankments) in dense forest, and evidently planted, and from the seed the surrounding 'Nahor forest has sprung up, and it is generally as straight as the old trees are the reverse" (*Ind. Tea Gaz.*). It is planted about Buddhist monasteries in Burma, and is also held in great estimation by Hindus. The timber is very strong, hard and heavy, and it is just its weight and hardness, and the difficulty of extracting it from the forest and converting it, that leads to its comparatively little use. It gives good sleepers, as good as those of *Pyingado* (*Xylia dolabriformis*), but the cost of cutting, extraction, conversion and freight is so great as to make its extended use unlikely. Where it can be cut and laid down near at hand, it should be invaluable, and the fine forests of it in the Assam valley should yield quantities of sleepers for the Assam-Bengal and other railways of those parts. It would also do well for wood-paving blocks. In the Andamans it has given squares up to 60 ft. long, 2 ft. siding, but more usually they are 30 ft. and 1 ft.

The weight and transverse strength have been determined by the following experiments:—

		Weight in lbs.	Value of P.
A. Mendis,	Ceylon, No. 59, old, 99, new, with bars 2′ × 1″ × 1″, found	72	994
Brandis,	Burma, No. 18, 1862 . . . . ,,	69	—
Bennett,	Andamans, No. 4, 1872 . . . . . . ,,	70	1053
Smythies,	Assam (4 specimens), 1878 . . . . . ,,	67·5	—
Smythies,	Kanara (1 ,,), ,, ... ,,	62	—
Smythies,	Burma (6 ,,), ,, ... ,,	70	—
Molesworth,	"Graphic Diagrams," etc. . . . . . . ,,	71	1040 E = 6000
H.H.O'Connell,	Tinnevelly, 1886 . . . . ,,	80	— α = 0·00545
Bourdillon,	Travancore, 1896 . . . . ,,	60	951

It is possible that O'Connell's specimens were unseasoned, and Bourdillon's of his lightest variety. Several of the specimens, however, reached 74 to 76 lbs. per cubic foot in weight. The wood is very durable. It is used for building, for bridges, gun-stocks, and tool-handles; but, as above explained, its more general use is prevented by its great hardness, weight, and the difficulty of working it. In Ceylon an oil is obtained from the nut, and used to burn and as an application to sores. The fruit is edible, and the flowers are used to perfume essences and oils.

			lbs.
E	2309.	E. Dúars, Assam	64
E	793.	Kámrúp „ (G. Mann)	61
E	2190.	Nowgong „	75
E	1273.	Cachar	70
E	3687.	Chittagong (Gamble)	71
W	741.	South Kanara (Cherry)	62
B	2504.	Burma (Brandis, 1862)	69
B	554.	Martaban (Seaton)	75
B	2700.	Tavoy (Wallich, 1828)	60
B	2238.	Andamans (Col. Ford, 1866)	76
B	2491.	„ (Home, 1874, No. 10)	67
B	520.	„ (Genl. Barwell)	74
No.	59.	Ceylon Collection (*Mesua Nagaha*) old; No. 99, new	72

Nordlinger's sections, vol. 11.

2. **M. Thwaitesii,** Planch. and Trian.; Fl. Br. Ind. i. 278; Trimen Fl. Ceyl. i. 106. Vern. *Diya-na*, Cingh.

A tree. *Bark* smooth. *Wood* reddish-brown, hard. *Pores* moderate-sized, scanty. *Medullary rays* very fine, numerous, short. Concentric lines apparently absent.

Moist low country of Ceylon, near streams.

The wood is used for building bridges, etc. The identification of the specimen is a little doubtful.

Ceylon Collection, No. 22, new (Mendis).

6. PŒCILONEURON, Beddome.

Two species, both of S. India. *P. pauciflorum*, Bedd. Fl. Sylv. t. 93; Fl. Br. Ind. i. 278; Vern. *Pudangalli*, is a large tree of the Ghát forests of Tinnevelly and Travancore, with a valuable, hard, reddish timber, used for building and to make walking-sticks.

1. **P. indicum,** Bedd. Fl. Sylv. t. 3; Fl. Br. Ind. i. 278. Vern. *Kirballi, ballagi*, Kan.; *Puthang kolli*, Tam.; *Vayila*, Mal.; *Vaiya*, Kader.

A large tree. *Wood* dark red, heartwood darker, very hard. *Pores* moderate-sized, ringed, single or in short slanting irregular lines. *Medullary rays* fine, numerous, the distance between them less than the diameter of the pores. Occasional very short, fine, white, concentrically running lines, especially in the sapwood.

Forests of Western India from S. Kanara to Travancore, at 3–4000 ft.

This is an important tree in the forests of South Kanara, and endeavours have been made to introduce the timber as a sleeper and paving-block wood. Some of the latter were shown at the Paris Exhibition of 1900, and looked very suitable. In S. Kanara, the tree is more or less gregarious, seeds profusely, and reproduces admirably, giving, besides being a useful tree in high forest for timber purposes, an excellent coppice growth for fuel-supply. The wood is used for rice-pounders in Travancore.

		lbs.
W 4733.	Travancore (Bourdillon)	59

ORDER XVI. TERNSTRÖMIACEÆ.

An Order containing 13 genera of forest interest, belonging to three Tribes.

Tribe I. Ternströmieæ	Anneslea, Ternströmia, Sladenia, Adinandra, Cleyera, Eurya.
„ II. Saraujeæ	Actinidia, Saurauja, Stachyurus.
„ III. Gordonieæ	Pyrenaria, Schima, Gordonia, Camellia.

The species mostly occur in the hills, chiefly in the Himalaya, the hills of S. India, those of Burma, and the upper ranges in Ceylon. Only one of them is of special forest importance, *Schima Wallichii* of the lower Darjeeling hills, but others are locally useful, especially in S. India and Ceylon. The tea plant is, of course, of the greatest importance.

Wood usually reddish, close- and even-grained, not liable to split. *Pores* small, uniformly distributed, numerous. *Medullary rays* fine or very fine, regular. *Eurya* and *Ternströmia* have a few broader rays alternating with the fine ones. *Actinidia* has the porous wood of a climber.

1. ANNESLEA, Wall. Two evergreen trees of Burma: *A. fragrans*, Wall.; Fl. Br. Ind. i. 280; Kurz For. Fl. i. 98 of the Eng forests and the Shan Hills, said by Kurz to have a "pale brown, rather heavy, close-grained wood, of a short fibre and rather brittle"; and *A. monticola*, Kurz; For. Fl. i. 98, of the hills of Upper Burma and Martaban, at 5–7000 ft.

2. TERNSTRÖMIA, Linn.

Three species. *T. emarginata*, Choisy; Fl. Br. Ind. i. 281; Trimen Fl. Ceyl. i. 108, is a shrub 10 to 16 ft. high, endemic in the upper montane zone of Ceylon, common on Horton's plains. *T. penangiana*, Choisy; Fl. Br. Ind. i. 281, is an evergreen tree found in Tenasserim and the Andamans.

1. **T. japonica,** Thunb.; Fl. Br. Ind. i. 280; Kurz For. Fl. i. 99; Trimen Fl. Ceyl. i. 107. *T. gymnanthera*, Bedd. Fl. Sylv. t. 91. Vern. *Kiamonu*, Badaga; *Pena-mihiriya, rattota, rattatiya*, Cingh.; *Taunglan*, U. Burma.

An evergreen tree. *Bark* brown, ½ in. thick, smooth or tesselated in small ridges by wavy vertical lines. *Wood* reddish-brown, moderately hard, smooth- and even-grained. *Pores* small, numerous, uniformly distributed. *Medullary rays* of two kinds—few moderately broad, short, with about 4 to 6 fine ones in the gaps between them, the distance between them equal to the diameter of the pores; on a radial section the rays show a pretty silver-grain. *Annual rings* faint.

Two localities—(1) in the hilly region from the Khasia Hills at 4–5000 ft. south to Martaban and Tenasserim; (2) in the hills of S. India and Ceylon at 4–7000 ft.; common in Nilgiri "Sholas."

A very handsome tree with yellow flowers which have the scent of jonquil. The wood is useful for building, but requires careful seasoning. Growth slow, 8 to 10 rings per inch of radius. Weight about 40 lbs. per cubic foot, the Coonoor specimen was from a young tree, and possibly not quite dry.

	lbs.
W 3750. Coonoor, Nilgiris, 6000 ft. (Gamble)	54
W 3890. Aramby Forest, Nilgiris, 7000 ft. (Gamble)	40
No. 120, Ceylon Collection, new (Mendis)	40
Nordlinger's Sections, vol. 10.	

3. SLADENIA, Kurz. *S. celastrifolia*, Kurz; Fl. Br. Ind. i. 281; Kurz For. Fl. i. 100, is a tree of the hills to the east of Bhamo in Upper Burma.

4. ADINANDRA, Jack. There are three Indian species. *A. villosa*, Choisy; Fl. Br. Ind. i. 283; Kurz For. Fl. i. 100, is an evergreen tree not uncommon in the open and Eng forests of Pegu. *A. Griffithii*, Dyer in Fl. Br. Ind. i. 282, is a tree of the Khasia Hills. *A. lasiopetala*, Choisy; Fl. Br. Ind. i. 283; Bedd. Fl. Sylv. xxiv.; Trimen Fl. Ceyl. i. 108; Vern. *Ratu-mihiriya*, Cingh., is a small endemic tree common in the montane region of Ceylon, especially about Newera Ellia.

A specimen of the wood of *A. dumosa*, Jack, sent by Ridley from Singapore to the

Kew Museum, has a light reddish-brown, soft, even-grained *wood;* numerous small, regular *pores;* and numerous fine, regularly distributed *medullary rays.* The wood is quite characteristic of the Order, and that of the Indian and Ceylon species is probably very similar.

5. CLEYERA, DC.

Two species. *C. grandiflora,* Hook. f. and Th.; Fl. Br. Ind. i. 284, is a small tree of the Khasia Hills in Assam, at 4000 ft.

1. C. ochnacea, DC; Fl. Br. Ind. i. 283.

A small tree. *Bark* reddish-brown, thin, smooth, with prominent round lenticels arranged in vertical lines. *Wood* moderately hard, yellowish-pink, very smooth, close- and even-grained. *Annual rings* marked by a dark broad line without pores. *Pores* small and very small, evenly distributed and numerous. *Medullary rays* very fine and regular, very numerous.

Central and Eastern Himalaya; Khasia Hills at 2000 ft.
Japan—Kew Museum (R. Oldham).

6. EURYA, Thunb.

Four species, all rather variable. *E. trichocarpa,* Korth.; Fl. Br. Ind. i. 285, is a small tree of the Eastern Himalaya and Khasia Hills.

Wood soft, light red, close- and even-grained, rather like pear wood. *Pores* small or very small. *Medullary rays* of two kinds, fine and moderately broad. *Medullary patches* prominent.

1. E. japonica, Thunb.; Fl. Br. Ind. i. 284; Brandis For. Fl. 24; Bedd. Fl. Sylv. t. 92; Kurz For. Fl. i. 101; Gamble Darj. List 7; Talbot Bomb. List 16; Trimen Fl. Ceyl. i. 109 (includes also *E. chinensis,* R. Br. and *E. ceylanica,* Wight of the Fl. Br. Ind.). Vern. *Jhingni,* Nep.; *Tungchong,* Lepcha; *Hooloori,* Badaga; *Taung-lapet,* Burm.; *Neya-dasse,* Cingh.

A small or moderate-sized tree. *Bark* thin, grey-brown, with lines of small lighter-coloured lenticels. *Wood* brown, soft, close-grained, with occasional medullary patches. *Pores,* small, scanty. *Medullary rays* fine to moderately broad, very numerous, close.

Eastern Himalaya from Nepal eastwards, at 3–6000 ft.; Khasia Hills; hill forests of Martaban and Tenasserim at 4–7000 ft.; hills of South India from the Konkan (doubtful) southwards, and of Ceylon, above 4000 ft.

A useful fuel tree. In Sikkim the trees are pollarded and left in jhúm cultivations so that the leaves may be regularly cropped for leaf-manure.

		lbs.
E 3723.	Kalimpúng, Darjeeling, 4000 ft. (Gamble)	—
W 3876.	Aramby Forest, Nilgiris, 7000 ft. ,, ...	45

2. E. symplocina, Bl.; Fl. Br. Ind. i. 284; Kurz For. Fl. i. 102; Gamble Darj. List 7. Vern. *Bara jhingni,* Nep.; *Flotungchong,* Lepcha.

A small evergreen tree. *Bark* brown, thin. *Wood* reddish-white, soft, close-grained, many medullary patches. *Annual rings* marked by more numerous pores in the spring wood. *Pores* very small. *Medullary rays* very fine and moderately broad, the latter short, prominent.

Hills of the Eastern Himalaya, from 5–7000 ft.; Burma, in the Martaban Hills, 7000 ft.

Weight, 38 lbs. per cubic foot. Used only for firewood. Growth moderate, 7 rings per inch of radius.

		lbs.
E 385.	Rangbúl, Darjeeling, 7000 ft. (Johnston)	35
E 2319.	" " " (Gamble)	42
E 3381.	Darjeeling, 6000 ft.	—

3. **E. acuminata,** Bl.; Fl. Br. Ind. i. 285; Kurz For. Fl. i. 101 (also *E. serrata*, Bl.; Kurz For. Fl. i. 102, according to Fl. Br. Ind.); Gamble Darj. List 8. *E. japonica*, Thunb.; Brandis For. Fl. i. 24 (part). Vern. *Bauri*, Kumaon; *Chhena*, Garhwal; *Jingan*, Dotiál; *Lapet*, Burm.

A small evergreen tree. *Bark* brown, thin, smooth. *Wood* reddish-brown, soft, even-grained, medullary patches conspicuous. *Pores* very small, evenly distributed. *Medullary rays* very fine and moderately broad, the latter smaller and less prominent than those of *E. symplocina*; silver-grain well marked.

Himalaya, from the Jumna eastwards, 5–8000 ft.; Eastern Bengal; Assam; hill forests, especially pine forests, of Martaban at 6–7000 ft.

An excellent fuel tree, not uncommon in the hills of Mussoorie and Malkot in Dehra Dún, and very like the tea-plant. Weight, according to Kyd, 32 lbs.; the specimen gives 47 lbs. Kyd's experiments on a bar 2′ × 1″ × 1″ gave P = 337 for wood from Goalpara.

		lbs.
E 2320.	Rangbúl, Darjeeling, 7500 ft. (Gamble)	47

7. ACTINIDIA, Lindl.

Two climbing shrubs. *A. strigosa*, Hook. f. and Th.; Fl. Br. Ind. i. 286; Gamble Darj. List 8; Vern. *Tikphal*, Nep.; *Taksing*, Lepcha, is common in the Sikkim Himalaya, at 6–8000 ft., and has a pleasant edible fruit.

1. **A. callosa,** Ldl.; Fl. Br. Ind. i. 286; Gamble Darj. List 8. Vern. *Tikphal*, Nep.; *Taksing*, Lepcha.

A large climbing shrub. *Bark* brown, rough, corky. *Wood* brown, soft, very porous. *Pores* of various sizes, numerous, small to large or very large. *Medullary rays* moderately broad, short, bent round the pores.

Himalaya from the Jumna (Dehra Dún, 3500 ft.—P. Mackinnon) eastwards, at 2–6000 ft.; Khasia Hills; Shan Hills of Burma.

Fruit edible, of good flavour, might be worth cultivation, especially as the plant (as also is *A. strigosa*) is very ornamental. In Japan the wood is used to make tobacco-boxes, on account of its porous character (Kew Museum).

E 2858. Tukdah Forest, Darjeeling, 5000 ft. (Gamble).
Nordlinger's Sections, vol. 9 (*A. arguta*, Pl.).

8. SAURAUJA, Willd.

A Genus of about nine small trees or shrubs with handsome, parallel-veined leaves which are generally scaly and rusty-tomentose, and pink or white flowers. *S. fasciculata*, Wall.; Fl. Br. Ind. i. 287; Gamble Darj. List 8; Vern. *Gokul*, *sare gogen*, Nep.; *Sipha*, Lepcha, is a pretty shrub, common about Darjeeling. The others, except those given below, are unimportant.

Wood light red or reddish-brown, soft. *Pores* small. *Medullary rays* fine, close and numerous.

1. **S. napaulensis,** DC; Fl. Br. Ind. i. 286; Brandis For. Fl. 25; Gamble Darj List 8. Vern. *Gogina, pangara, gogana, goganda,* Hind.; *Gogan,* Kumaon; *Gogen,* Nep.; *Kasúr,* Lepcha.

A small tree. *Bark* reddish-brown, thin. *Wood* light pink, very soft, spongy; shrinks much. *Pores* small. *Medullary rays* fine and moderately broad, prominent on a radial section.

Outer Himalaya from the Sutlej to Bhutan above 3000 ft.; Khasia Hills. Flowers pink; the leaves are lopped for cattle fodder.

		lbs.
E 2321.	Tukdah, Darjeeling, 5000 ft. (Gamble)	25

2. **S. Roxburghii,** Wall.; Fl. Br. Ind. i. 287; Kurz For. Fl. i. 103; Gamble Darj. List 8. *Ternströmia serrata,* Roxb. Fl. Ind. ii. 521. Vern. *Dalúp,* Sylhet; *Ouli gogen,* Nep.; *Dangsipha,* Lepcha; *Laidonto,* Mechi.

A small tree. *Bark* thin, reddish-brown. *Wood* reddish-brown, soft, with large central pith. *Pores* small, very numerous. *Medullary rays* fine, very numerous and closely set.

Eastern sub-Himalayan tract, Khasia Hills, Eastern Bengal and Burma, up to 4000 ft.

		lbs.
E 3271.	Borojhar Reserve, Western Dúars (Gamble)	42

3. **S. Griffithii,** Dyer in Fl. Br. Ind. i. 286; Gamble Darj. List 8. Vern. *Gogen,* Nep.; *Hlosipha,* Lepcha.

A small tree. *Bark* thin, grey-brown, with very prominent corky lenticels. *Wood* light brown, soft. *Pores* small, scanty. *Medullary rays* fine, close, numerous.

Sikkim Himalaya, at 3–5000 ft., common about Sitong, otherwise scarce; Assam. A very handsome plant with large leaves, bright green above, densely yellow-tomentose beneath. Berries white.

E 3637. Sitong, Darjeeling, 4000 ft. (Gamble).

4. **S. punduana,** Wall.; Fl. Br. Ind. i. 287; Kurz For. Fl. i. 103; Gamble Darj. List 8. Vern. *Ratu gogen,* Nep.; *Sipha,* Lepcha.

A small tree. *Bark* dark brown, vertically cleft, with prominent lenticels. *Wood* light brown, soft, resembling that of *S. Griffithii,* but with rather larger *pores.*

Sikkim Himalaya, up to 5000 ft.; Assam; U. Burma; tropical forests of Martaban at 2–3000 ft.

A very pretty tree with pink flowers, leaves very yellow-tomentose beneath, and white berries.

E 3722. Kalimpúng, Darjeeling, 5000 ft. (Gamble).

9. STACHYURUS, Sieb. and Zucc. *S. himalaicus,* Hook. f. and Th.; Fl. Br. Ind. i. 288; Gamble Darj. List 8, is a small straggling tree of the Eastern Himalaya, from Nepal to Bhutan, at 5–8000 ft.

10. PYRENARIA, Blume. Four evergreen trees or shrubs of Eastern Bengal and Burma. *P. camelliæflora,* Kurz; *P. attenuata,* Seem. (*P. serrata,* Bl.; Kurz For. Fl. i. 105) and *P. diospyricarpa,* Kurz, are found in Burma, chiefly in the hill forests of Martaban. *P. barringtoniæfolia,* Seem.; Fl. Br. Ind. i. 290, is a shrub of the Gáro Hills in Assam.

11. SCHIMA, Reinw.

Seven species, all of the Eastern Himalaya, Khasia Hills and Burma. King, however, in "Materials for a Flora of the Malay Peninsula," reduces these to four, and apparently places *S. mollis*, Dyer, and *S. monticola*, Kurz, as well as *S. crenata*, Korth., all under *S. Noronhœ*. As the latest worker, with the advantage of the fuller material, he is probably the most likely to be right. *S. khasiana*, Dyer Fl. Br. Ind. i. 289, is a white-barked tree of the Khasia Hills at 4–6000 ft. *S. bancana*, Miq.; Kurz For. Fl. i. 108, is a tree of the Eng forests of the lower hills of Tenasserim and Martaban, up to 3000 ft.

Wood red or reddish-brown, rough, moderately hard. *Pores* small, numerous, uniformly distributed. *Medullary rays* very fine, numerous, equidistant.

1. S. Wallichii, Choisy; Fl. Br. Ind. i. 289; Kurz For. Fl. i. 106; Gamble Darj. List 8. *Gordonia integrifolia*, Roxb. Fl. Ind. ii. 572. Vern. *Chilauni*, *goechassi*, Nep.; *Makusal*, Hind.; *Sumbrong*, *súngsúng*, Lepcha; *Gugera*, Goalpara; *Makriah chilauni*, *makusal*, *nogakat*, *nogabé*, Ass.; *Dingan*, Khasia; *Boldak*, *gugera*, Gáro; *Jam*, Cachar; *Gogra*, *phulgogra*, Mechi; *Sangraban*, Magh.; *Sambaw*, Arr.; *Mukru*, Manipur.

A large evergreen tree. *Bark* black or dark grey, with deep vertical cracks. *Wood* rough, red, moderately hard, shrinks much in seasoning, but is durable. *Pores* small, round, very numerous, uniformly distributed. *Medullary rays* very fine, uniform, short, wavy, bent round the pores, very numerous: the silver-grain visible as narrow, dark-coloured plates.

Eastern Himalaya from Nepal eastwards, common in Darjeeling, up to 5000 ft.; Assam, Khasia Hills and Chittagong; hills of Upper Burma.

This beautiful tree is probably, after the Sál, the most important of the trees of the lower forests of the Darjeeling and Jalpaiguri districts. It is essentially a tree of the lower hills, and ascends only a little way, at most up to 6000 ft., while it is quite scarce a few miles out from the foot of the hills. The "Darjeeling List" says, "It is 'perhaps most common in the forests east of the Tista, and in the Murti-Jaldoka 'forest and the Lower Hills towards the Bhutan frontier it is the prevailing tree. 'Fine forests of it also exist in the Dalka Jhar, on the Bamunpokri upper plateau, and 'at Sukna. In the hills it is generally smaller, and at Kalimpúng is generally 'preserved in cultivated lands for the branches, which are cut off and burnt for 'manure. It coppices well, and is profusely regenerated from seed, provided that 'sufficient light is obtainable for the seedlings." In thick forests seedlings are rarely found, but wherever light is admitted, and the soil has been sufficiently stirred, they come up freely. The growth is moderately fast, about 4 to 8 rings per inch of radius.

The following experiments have been made to determine the weight and transverse strength :—

	Weight in lbs.	P =
Kyd with Goalpara wood in 1831, No. 48, bar 2′ × 1″ × 1″, found .	43	383
Brandis with Sikkim wood in 1864, bar 6′ × 2″ × 2″, found . .	45	760

The average of the specimens examined is 44 lbs., which is probably a correct estimate.

The wood is durable: E 1449, brought by Griffith from the Mishmi Hills in 1836, was perfectly sound when cut up in 1878. It is used in Northern Bengal and Assam for many purposes, but chiefly for building. Many of the tea factories in Darjeeling have been built of it, and the Public Works Department have sometimes used it for bridges. Mann states that in Assam it is used for planks and ordinary building purposes and for canoes. S. E. Peal says of it, "The grain is even and close and in 'general working qualities and colour it is very like *Jutuli* (*Altingia excelsa*). If 'the wood is cut into planks, the sapwood should first be removed; even then, if the 'planks are wide, care should be taken to keep the ends moist or shaded from the sun,

'or they will split. It is rather heavy for boxes" (*Ind. Tea Gaz.*). Hooker, in the "Himalayan Journal," i. 157, says, "It is much prized for ploughshares and other 'purposes needing a hard wood." In 1875 several sleepers were made over to the Northern Bengal State Railway for experiment, but the result is not known to me.

Like its relative, the tea-plant, the *chilauni* is liable to the attacks of "mosquito 'blight," a Hemipterous insect, *Helopeltis theivora*, Moore.

		lbs.
E 491.	Bamunpokri Forest, Darjeeling (Manson)	43
E 646.	Khooklong Forest, Darjeeling Terai (Manson)	44
E 3602.	Sivoke Forest, Darjeeling Terai (Gamble)	41
E 636.	Eastern Dúars, Assam (G. Mann)	42
E 1449.	Mishmi Hills (Griffith, 1836)	50

Nordlinger's Sections, vol. 10. (*S. Wallichii* and *Gordonia Wallichii*) (Tab. I. 5).

2. **S. Noronhæ**, Rwdt.; Kurz For. Fl. i. 107. *S. crenata*, Korth.; Fl. Br. Ind. i. 107. Vern. *Panma, thityabyu*, Burm.

An evergreen tree. *Bark* brown, irregularly cracked. *Wood* reddish-brown, moderately hard, close-grained. *Pores* small, in short radial lines between the very fine and closely-packed *medullary rays*.

Tenasserim and Martaban Hills.

		lbs.
B 299.	Burma (1867)	45

There is some doubt about the identification of this number.

12. GORDONIA, Ellis.

Four species, one from N. India, one from the hills of S. India, and two from Ceylon. *G. excelsa*, Bl.; Fl. Br. Ind. i. 291; Gamble Darj. List 9, is a tree of the Sikkim and Bhutan Himalaya, at 4–6000 ft. *G. zeylanica*, Wight; Fl. Br. Ind. i. 291; Trimen Fl. Ceyl. i. 110 (including *G. elliptica*, Gardn.; Fl. Br. Ind. i. 291), and *G. speciosa*, Thw.; Fl. Br. Ind. i. 292; Trimen Fl. Ceyl. i. 111, are fine trees of the Ceylon Hills. The former, Vern. *Mihiriya*, Cingh., has a grey smooth bark and red wood, used in building at Newera Eliya.

1. **G. obtusa**, Wall.; Fl. Br. Ind. i. 291; Bedd. Fl. Sylv. t. 83; Talbot Bomb. List 17. Vern. *Nagetta*, Badaga.

A tall tree. *Bark* brown, smooth. *Wood* pinkish-white to reddish-brown. *Pores* small, very numerous, uniformly arranged between the fine, short, very numerous *medullary rays*, the distance between which is equal to the transverse diameter of the pores. *Annual rings* faintly marked by a line. Silver-grain good and pretty.

Western Ghâts of Bombay and Madras, up to 6000 ft.

This tree is quite common in the dry "sholas" on the eastern side of the Nilgiris, and very pretty when in flower. It has a good straight upright growth, but the diameter growth is slow, about 8 to 9 rings per inch of radius. The wood is occasionally used for building, but is liable to warp. Bourdillon's Travancore experiments of 1896 give weight 40 lbs., P = 533.

		lbs.
W 3765.	Coonoor, Nilgiris, 6000 ft. (Gamble)	—
W 4607.	Travancore (Bourdillon)	43

13. CAMELLIA, Linn.

There are four species of Indian wild teas, and perhaps a fifth. They come into two sections: I. THEA, containing *C. Thea* and *C. caudata*; and II. CAMELLIA, containing *C. drupifera* and *C. lutescens*, Dyer in Fl. Br. Ind. i. 293, a shrub of the Mishmi Hills.

C. japonica, L. is the cultivated garden Camellia, which grows well in the Nilgiri Hills and elsewhere where the climate is sufficiently temperate. It has a light brown *wood*, with numerous very small evenly-distributed *pores* and short *medullary rays*, broader at the middle than at the ends (Nordlinger's Sections, vol. 8).

Wood light-coloured, moderately hard, close- and even-grained. *Pores* numerous, very small, uniformly distributed. *Medullary rays* very fine, very numerous.

1. **C. Thea,** Link; Brandis For. Fl. 25; Kurz For. Fl. i. 109; Gamble Darj. List 9. *C. theifera*, Griff.; Fl. Br. Ind. i. 292. The Tea plant. Vern. *Cha*, Hind.; *Lapet*, Burm.

A shrub or small tree. *Bark* thin, grey, smooth. *Wood* creamy-white or greyish-white, moderately hard, close- and even-grained. *Pores* numerous, very small, uniformly distributed. *Medullary rays* very fine, numerous.

Upper Assam, Manipur and Cachar; Katha forests, Ruby Mines District and Shan Hills of Burma; cultivated in many districts, especially in Kangra, Kulu, Dehra Dún, Kumaon, Darjeeling, the Western Duárs, Assam, Cachar, Chittagong, Hazáribagh, Nilgiri Hills, Pulney Hills, the hills of Travancore and Ceylon.

It is unnecessary to describe at length the Indian tea-industry and the discovery of the wild plant in Assam, for the subject is fully treated by Dr. G. Watt in his "Dictionary of Economic Products," vol. ii. The shrub is sometimes found run wild in the forests, elsewhere than in the regions where it is indigenous.

		lbs.
O 3143.	Dehra Dún (Bailey)	56
E 5104.	Darjeeling (C. G. Rogers)	48

2. **C. caudata,** Wall.; Fl. Br. Ind. i. 293; Kurz For. Fl. i. 108. Vern. *Lapet*, Burm.

An evergreen shrub. *Bark* light brown, smooth, very thin. *Wood* yellowish-white, close- and even-grained. *Pores* very numerous, extremely small, regular, some containing a white substance. *Medullary rays* very fine, very numerous, occasionally fine and dark-coloured.

Eastern Himalaya in Bhutan and the Mishmi Hills; Khasia Hills and Sylhet; Martaban Hills of Burma, at 3–6000 ft.

Khasia Hills—Kew Museum (J. D. Hooker).

3. **C. drupifera,** Lour.; Fl. Br. Ind. i. 293; Kurz For. Fl. i. 109; Gamble Darj. List 9. Vern. *Kissi, hingua*, Nep; *Chashing*, Bhutia, Lepcha; *Lapet*, Burm.

A large evergreen shrub. *Bark* very thin, greyish-white. *Wood* pinkish-white, moderately hard, close- and even-grained. *Pores* very small, uniformly distributed, very numerous. *Medullary rays* very fine, very numerous.

Eastern Himalaya, Assam and Khasia Hills, up to 8000 ft.; Tenasserim and Andaman Islands.

		lbs.
E 3111.	Kalimpúng, Darjeeling, 4500 ft. (Gamble)	—
E 3358.	Sivoke Hills, Darjeeling, 1500 ft. „	60

ORDER XVII. DIPTEROCARPEÆ.

An Order of very great importance in the forest economy of India, Burma and Ceylon, containing, as it does, some of the largest and finest trees, and some of the most important timbers. Many of them are especially valuable, because they are, like the Sál tree of North and Central India, and the Eng tree of Burma, gregarious kinds, and consequently suitable for careful working in forest. The latest account of the Order is contained in Sir D. Brandis' "Enumeration of the Dipterocarpeæ," in vol. xxxi. of the *Journal of the Linnean Society*, and it is that which it is proposed to adopt here in giving an account of the trees and their woods and timbers.

Besides being valuable as timber trees, most Dipterocarps abound in resin or wood-oil. On this Brandis says, "Dipterocarps form resinous substances on a large scale in 'their leaves and deposit them in their wood. In the living tissue these substances 'are in a liquid, oily condition; while in the old wood solid, in *Dryobalanops* crystalline, 'masses are deposited."

Most Dipterocarps are characterized by tall stems with no or only small branches. Thus, the huge *Dipterocarpus* trees of Eastern Bengal, Burma and Ceylon are at once recognizable by their tall straight leafless boles, from which the branches only begin to show at a considerable height above the ground. And the same peculiarity is noticeable in the Sál and other similar species of *Shorea*. As young trees, they grow straight up, if gregarious preferring to be in close approximation to each other, and in the distance a forest of such trees often presents the uniform appearance which is characteristic of the forests of spruce in England.

Brandis divides the family into five Tribes with 16 genera, of which 13 occur in the areas to which this work relates. Among the other three, one, *Dryobalanops*, is especially noticeable, as containing the Camphor tree of Sumatra, the Malay Peninsula and Borneo, *D. aromatica*, Gaertn. f. The following account of it appeared in *Nature* in February 1871:—

"One of the most interesting and important trees of Sumatra is the Camphor tree, '*Dryobalanops camphora*. This camphor attracted the attention of the earliest voyagers, 'and was then, as it is now, an important article of commerce with China and Japan, 'the people of those countries attributing to it extraordinary virtues and paying a high 'price for it. The tree grows to a height of 100 or 130 ft., and forms a trunk 7 to 10 ft. 'in diameter. The quantity of camphor contained in the trunks is very unequal; the 'young trees appear to contain little or none. It is said that, on an average, about nine 'trees are required to produce 100 lbs. weight of crystallized camphor. It is obtained by 'cutting down the tree and dividing the wood into small pieces, in the divisions of 'which the camphor is found. It differs in the form of its crystals from the camphor of 'commerce, is harder, more brittle, and does not so readily condense. Great quantities 'are used by the Bataks for the preservation of the corpses of their chiefs. The trees 'are spread over a portion only of Sumatra and Borneo, and generally occur in localities 'into which commerce and civilization have as yet but little penetrated. Notwith-'standing the contiuued destruction of the trees, for the sake of procuring the camphor, 'no means are taken for the future preservation of the species. This camphor is 'seldom seen in England, except in museums. The Chinese eagerly buy it in preference 'to the ordinary camphor—their own produce—which they send in such large quantities 'into the European markets."

Another account is given by H. T. Colebrooke in "Asiatic Researches," vol. xii. p. 537 (1818), from which it would appear that the procedure formerly was much more wasteful, as only trees were sought for that had cavities in which the camphor had crystallized. The wood of *Dryobalanops* resembles that of *Dipterocarpus* (Ridley in Kew Museum).

Tribe I. Dipterocarpeæ	Dipterocarpus, Anisoptera.
" II. Shoreæ	Doona, Hopea, Pentacme, Shorea, Parashorea, Balanocarpus.
" III. Vaticeæ	Cotylelobium, Vatica.
" IV. Vaterieæ	Stemonoporus, Monoporandra, Vateria.

Wood generally hard, strong and durable; reddish or yellowish-

brown, often cross-grained; heartwood distinct, resinous. *Pores* round, often in groups, small to large, generally moderate-sized, often filled with resin, enclosed in a ring of loose texture due to large wood-cells. *Medullary rays* fine and moderately broad, generally equidistant, silver-grain usually good.

Tribe I. DIPTEROCARPEÆ.

1. DIPTEROCARPUS, Gaertn. f.

Seventeen described species, of which five are endemic Ceylon species; two are found in South India, and the rest in Eastern Bengal, Burma or the Andaman Islands. *D. vestitus*, Wall.; Fl. Br. Ind. i. 295, is a tree of Tavoy which is not mentioned by Kurz. *D. Bourdilloni*, Brandis in Hook. Ic. Pl. t. 2403; Journ. Linn. Soc. xxxi. 34, is an enormous tree, 150 ft. high, with a straight trunk 5 ft. in diameter. It was found by Bourdillon in evergreen forests on the Periyar river in N. Travancore at 2–500 ft. (Vern. *Kar anjili*, Trav. hills), and by Brandis on the Carcoor Ghát in Malabar. The wood is not good, but the stems are used to make dug-out canoes. *D. costatus*, Gaertn. f.; Kurz For. Fl. i. 117, is a tree of Eastern Bengal and Burma, found in the hill Eng forests of the hills of Martaban and Tenasserim, up to 2000 ft. *D. scaber*, Ham. is found in the hills of S. Tippera. *D. incanus*, Roxb.; Fl. Ind. ii. 614, is found in Pegu and the Andamans. *D. Griffithii*, Miq.; Fl. Br. Ind. i. 209; Kurz For. Fl. i. 116, is a large tree, up to 150 ft. in height, of Tenasserim and the upper mixed forests of the Andamans. *D. hispidus*, Thw.; Vern. *Bu-hora*, Cingh.; *D. scabridus*, Thw.; *D. glandulosus*, Thw.; Vern. *Dorana*, Cingh.; and *D. insignis*, Thw.; Trimen Fl. Ceyl. i. pp. 114–116, are trees of Ceylon.

Wood reddish-brown, hard. *Pores* moderate-sized and large, often resinous, usually surrounded by a pale ring. *Medullary rays* usually of two classes, the one fine or very fine, the other moderately broad or broad; silver-grain well marked.

1. **D. indicus**, Bedd. Fl. Sylv. t. 94; Brandis Journ. Linn. Soc. xxxi. 26. *D. turbinatus*, Dyer; Fl. Br. Ind. i. 295 (part); Talbot Bomb. List 17. Vern. *Guga, challane*, Kan.; *Ennei*, Tam.; *Kalpayin*, Mal.; *Varangu, velayani*, Trav. Hills.

A lofty tree. *Wood* dark reddish-grey, hard. *Pores* moderate-sized to large, scanty, ringed. *Medullary rays* fine, long, irregular.

Evergreen forests of the Konkan, Kanara, Malabar and Travancore, up to 3000 ft.

Beddome says the timber is open in the grain and not durable, Bourdillon that it is soft but useful for building. It gives a wood-oil. Bourdillon gives weight 47 lbs., P = 695. Dr. T. Cooke reunites this species with *D. turbinatus*, Gaertn.

	lbs.
W 4710. Travancore (Bourdillon)	44

2. **D. turbinatus**, Gaertn. f.; Fl. Br. Ind. ii. 295 (part); Roxb. Fl. Ind. ii. 612; Kurz For. Fl. i. 114. *D. lævis*, Ham.; Kurz For. Fl. i. 114. The Gurjun-oil tree. Vern. *Gurjun, tiliya-gurjun*, Beng.; *Kanyoung*, Magh.; *Kanyin, kanyinni, kanyin-wettaung*, Burm.

A lofty evergreen tree. *Wood* rough, soft to moderately hard, sapwood white, heartwood red-brown. *Pores* round, moderate-sized to large, numerous, ringed, joined by pale concentric bands. *Medullary rays* prominent, of two classes, broad and fine, a large number of the latter between each pair of the former, prominent and shining on a radial section.

Forests of Cachar and the Chittagong Hills; tropical forests throughout Burma; Andaman Islands.

A magnificent tree, reaching 150 to 200 ft. in height. In Chittagong it is conspicuous, and in the Hill Tract reserves it forms the highest tier of the forest vegetation, having beneath it in a second tier trees which are themselves very large and valuable. The wood-oil is largely collected and exported, "20 to 30 trees give 150 to 200 lbs. of 'oil, capable of making 2000 to 3000 torches, selling locally at Rs.1 8*a*. per 100" (Burma Forest Report, 1881–82). It is also used for painting houses and ships. "To extract 'the oil, a hole is made, about 3 to 5 ft. above the root of the tree, and burnt with a 'few dried leaves every third day. Oil from ½ to 1½ seer collects in the hole during the 'night, in the hot season, and is taken out next morning by a spoon formed of cocoanut-'shell. It is in much demand, and sells at from 6 to 10 rupees a maund. More than '4000 to 5000 maunds of oil are exported yearly to Calcutta and other parts" (Lewin, "The Hill Tracts of Chittagong").

The wood is used in housebuilding and for dug-out canoes, also for packing-cases; but it is soon destroyed by white ants, and therefore not much in estimation, though the large size of the logs and scantling points to its value for temporary purposes. Logs 40 to 60 ft. in length are often brought out.

Skinner, No. 64, gives the weight at 45 lbs. and P = 762; Kurz gives 55 lbs. for the weight, while the specimens examined average 50 lbs. per cubic foot. In the Andamans it squares up to 60 ft., siding 24 in.

		lbs.
E 709.	Chittagong Forests (Chester)	49
E 3690.	Chittagong Hill Tracts (Gamble)	51
B 292, 293.	Burma (1867)	43
B 2506.	„ (Brandis, 1862)	49
B 2555.	„ „ „	56
B 2216.	Andaman Islands (Col. Ford, 1866)	52

3. **D. obtusifolius**, Teysm.; Fl. Br. Ind. i. 295; Kurz For. Fl. i. 115. Vern. *Kanyingôk*, *inbo*, Burm.

A large deciduous tree. *Bark* ¾ in. thick, ash-grey, longitudinally cracked, rough. *Wood* reddish-brown, rough, moderately hard. *Pores* large and moderate-sized, ringed. *Medullary rays* moderately broad, numerous, making a good silver-grain.

Eng forests of Prome and Martaban, ascending to 3000 ft.

Weight 55 lbs. per cubic foot. Wood similar to "Eng."

		lbs.
B 3128.	Kya-eng, Attaran Valley, Burma	59
B 4073.	Tavoy (Palmer)	51

4. **D. pilosus**, Roxb. Fl. Ind. ii. 615; Fl. Br. Ind. i. 296; Kurz For. Fl. i. 115. Vern. *Hollong*, Ass.

A large evergreen tree. *Wood* light red, moderately hard. *Pores* numerous, moderate-sized, ringed, single or grouped in a roughly concentric arrangement. *Medullary rays* fine to moderately broad, the distance between them rather greater than the diameter of the pores.

Upper Assam, very common in damp forests; Chittagong, Arracan and Burma. Not gregarious.

A fine tree which likes well-drained land. It is often of very large size. "Blackwater" in *Ind. Tea Gaz.*, Sept. 1, 1883, mentions one 9 ft. in girth and 120 ft. to the first branch, another 18 ft. girth and 90 ft. to first branch, and a third 23 ft. in girth and perhaps 100 ft. high. He says the wood is a splendid one for sawing, but is not suited for tea-boxes on account of the resin in it. Chev. Paganini, in *Ind. Tea Gaz.*, April 28, 1885, says, however, that it *is* used for boxes, but is not durable. S. E. Peal thinks it must have formerly been largely used for canoes, though now it rarely is.

		lbs.
E 4700.	Dibrugarh, Assam (H. C. Hill)	43

5. D. tuberculatus, Roxb. Fl. Ind. ii. 614; Fl. Br. Ind. ii. 297; Kurz For. Fl. i. 113. *D. grandiflorus*, Wall. The Eng tree. Vern. *Eng, in*, Burm.; *Sooahn*, Taleing.

A large deciduous gregarious tree. *Bark* dark grey. *Wood* dark red-brown, hard. *Pores* circular, large and moderate-sized, often filled with resin, rather unevenly distributed. *Medullary rays* prominent, moderately broad, with a number of fine rays between each pair of broad ones; the distance between the broader rays equal to or up to twice the transverse diameter of the pores, the smaller rays passing through or round the pores.

Plains and low hills in the valleys of Burma, the chief constituent tree of the "Eng deing," one of the most characteristic of the Indian classes of forest; Chittagong.

The Eng forests of Burma correspond more or less to the Sál forests of Northern and Central India; and, as Brandis points out, the conditions of growth and the advantages which such gregarious trees possess in the struggle for existence are the same for both. The forests are chiefly and almost exclusively found on laterite, and are badly subject to fire in the dry season. They cover several thousand square miles of country, over 2000 in Pegu alone. For an account of the companion trees of Eng (properly "In"), reference may be made to p. 36 of Kurz' "Preliminary Report of Pegu, 1875." The wood of the Eng is probably the best of the woods given by species of *Dipterocarpus*, and it is in considerable demand and use for building and boats. Were it not that Burma has so many valuable timbers, and especially teak, Eng would probably be in even greater demand.

Weight: Brandis in Burma List of 1862, No. 12, gives 55 lbs.; Skinner, No. 63, gives 45, and Benson 46 lbs.; while the average of the specimens gives 54 lbs. Benson gives P = 758, Skinner 750.

It has been often recorded that the Eng tree did not give a wood-oil, but J. W. Oliver (see Watt Dict. Econ. Pts. iii. 160) explains that it does give a thick oil or rather oleo-resin, which is extracted for making torches and for caulking boats. The method of extraction is similar to that employed for gurjun-oil. The value of the torches is given by Brandis in 1875 as 64 per rupee, by Branthwaite in 1892 as 25 per rupee (for further information see Watt's Dictionary above referred to; Brandis in Ind. Forester i. 365; Branthwaite and H. Hobart-Hampden in Ind. Forester xviii. 8).

		lbs.
B 2505.	Burma (Brandis, 1862)	50
B 306.	„ (1867)	52
B 2480.	„	59

Nordlinger's Sections, vol. 8 (*D. grandiflorus*, Wall.) and vol. 11 (Tab. II. 1).

6. D. zeylanicus, Thw.; Trimen Fl. Ceyl. i. 114; Fl. Br. Ind. i. 297; Bedd. Fl. Sylv. xxv. Vern. *Hora*, Cingh.

A very tall tree with straight trunk, branching only near the top. *Bark* smooth, flaking off in small pieces. *Wood* red, moderately hard. *Pores* moderate-sized to very large, scanty, prominent on a vertical section. *Medullary rays* fine and moderately broad, frequently bending.

Ceylon, up to 3000 feet, but chiefly in the moist low country, endemic.

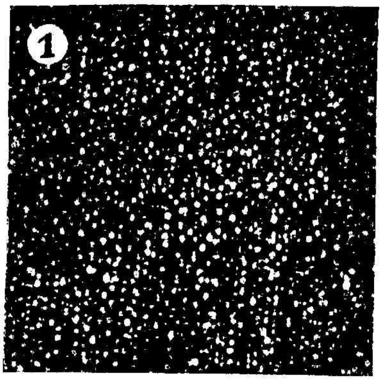
It is not clear why Mendis calls this "Thief tree." Trimen says the wood is not durable, but, as long lengths are obtainable, it is valuable for scaffolding. It gives a wood-oil and gum-resin.

	lbs.
No. 37. Ceylon Collection, old; No. 52, new (Mendis)	45

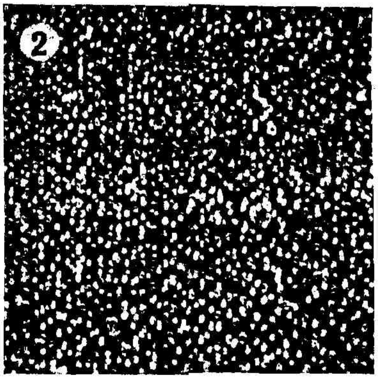
7. D. alatus, Roxb. Fl. Ind. ii. 614; Fl. Br. Ind. i. 298; Kurz For. Fl. i. 116. Vern. *Kanyinbyu*, Burm.

A very large tree with grey bark. Sapwood white; heartwood reddish-grey, moderately hard, smooth, mottled. *Pores* scanty, large ringed, often oval and subdivided. *Medullary rays* undulating, long,

II.



DIPTEROCARPUS TUBERCULATUS.



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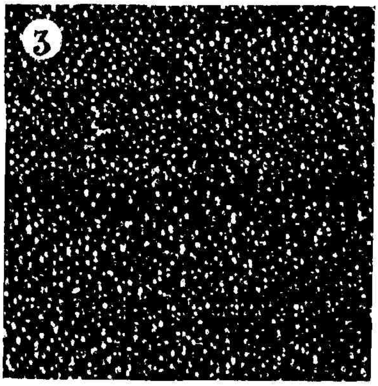
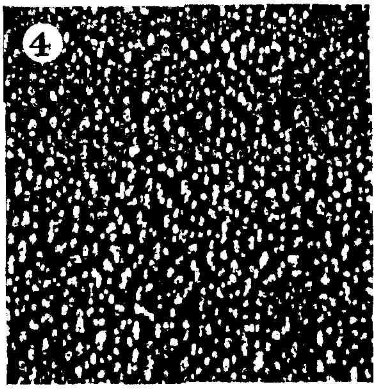
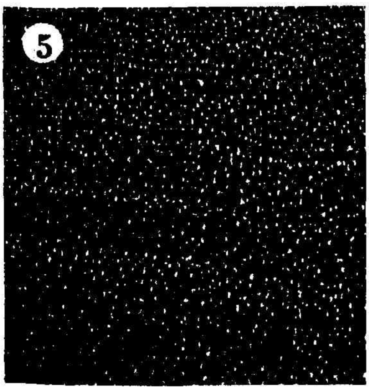


SHOREA ROBUSTA.



VATERIA INDICA.



ÆGLE MARMELOS.

BALANITES ROXBURGHII.

(*Magnified* $3\frac{1}{2}$ *times.*)

fine and moderately broad, some 2 to 6 fine ones between each pair of broad ones. Pores prominent on a longitudinal section.

Tropical forests of Bhamo, Arracan, Pegu and Martaban down to Tenasserim; Cocos Islands (Prain); Mascal Island (Roxburgh).

This fine tree grows chiefly on laterite. It gives a large quantity of rather thin wood-oil, which, according to Brandis, is found chiefly in the long horizontal cells of the medullary rays, which are up to 0·08 to 0·12 in. long. The oil is probably considerably mixed with that of the Eng.

Weight: Brandis in Burma List, 1862, No. 11, gives 38 lbs.; the specimen gives 50 lbs.; Bennett, No. 9, Andaman woods (*Kanyin*), gives weight 49 lbs., P=727. The wood is used for house-building and canoes, but is not durable.

		lbs.
B 818.	Burma (Ribbentrop)	50
B 2243.	Andamans (1866) (rather eaten)	38

Nordlinger's Sections, vol. 8.

E 720 is a wood sent from Chittagong under the name *Michamma*. In structure it resembles *Dipterocarpus*, and differs chiefly by the very numerous, very fine, equidistant *medullary rays*. The *pores* are joined by white, wavy concentric lines. The wood is interrupted by concentric belts of fibrous substance resembling liber, about ¼ inch thick.

E 1257 (43 lbs.) from Tezpur, Assam, has the structure of *Dipterocarpus*.

E 1960 (37 lbs.); Vern. *Lowa*, Beng.; *Chakyai*, Magh, from Chittagong, is probably a species of *Dipterocarpus*. It is distinguished by numerous broad and fine medullary rays, and moderate-sized, often subdivided pores.

These specimens are mentioned, as perhaps some day they may be identified. There are probably some other species of *Dipterocarpus* yet to be collected and properly determined.

2. ANISOPTERA, Korth.

Two Indian species. *A. oblonga*, Dyer in Fl. Br. Ind. i. 301 (*Shorea nervosa*, Kurz For. Fl. i. 119), is a tree of Tenasserim which gives a clear yellowish resin like colophany.

Brandis says that "in the circumference of the pith there are 18 to 24 resin ducts, often large and close together."

1. A. glabra, Kurz For. Fl. i. 112. Vern. *Thinkadu*, Burm.

A large evergreen tree. *Bark* (of young trees) light brown with shallow vertical clefts, ⅛ in. thick. *Wood* reddish-brown, moderately hard, rough-grained. *Pores* large, often subdivided, not numerous or evenly distributed, often resinous. *Medullary rays* moderately broad, numerous, giving a shining silver-grain.

Evergreen forests of Upper Burma, the eastern slopes of the Pegu Yoma and the Martaban Hills.

This is a very large tree, for Kurz says it runs up to 120 ft. with 12 ft. in girth. The wood resembles that of *Dipterocarpus*.

		lbs.
B 4853.	Pyinmana, Burma (G. E. Cubitt)	38
B 5071.	Thaungyin, Burma (Cappel)	38

TRIBE II. SHOREÆ.

3. DOONA, Thw.

Twelve species, all endemic Ceylon trees, most of them quite rare and local. Eleven of them are described by Trimen under *Doona*, the twelfth is *D. disticha*, Pierre (*Vatica disticha*, A. DC; Fl. Br. Ind. i. 303. *Sunaptea disticha*, Trimen Fl. Ceyl. i. 127). *D. trapezifolia*, Thw.; Fl. Br. Ind. i. 311; Trimen Fl. Ceyl. i. 121; Vern. *Yakahalu*, Cingh., is a large tree of the moist low country up to 2500 ft. or more. The dried fruits

are pounded and made into flour for food, but are said to be available only every seventh year.

1. **D. zeylanica,** Thw.; Fl. Br. Ind. i. 311; Bedd. For. Fl. t. 97; Trimen Fl. Ceyl. i. 119. Vern. *Dún*, Cingh.

A large tree. *Bark* rough and cracked. *Wood* brown, moderately hard. *Pores* large, often subdivided, enclosed in rings of pale loose tissue which sometimes run together into irregular patches. *Medullary rays* prominent, fine, uniform and equidistant, not numerous.

Central Province of Ceylon, up to 4000 ft.

This is a characteristic tree of the lower hill forests, now fast disappearing to make way for tea. Trimen says of it, "The mode of branching horizontally chiefly at the 'top, and the preference of the tree for the crests of hills, which causes its outline to 'stand out against the sky, gives the tree at a distance much the appearance of the 'stone pine of Italy. The timber is light, moderately hard, pale greyish-brown, 'durable, and greatly in request for shingles, whence the tree is often called 'Shingle 'tree.' It burns with a bright flame. An excellent colourless dammar-like resin exudes 'from the trunk."

	lbs.
No. 25, Ceylon Collection, old; No. 28, new (Mendis)	29

2. **D. cordifolia,** Thw.; Fl. Br. Ind. i. 312; Trimen Fl. Ceyl. i. 122. Vern. *Beraliya*, Cingh.

A large tree. *Bark* smooth, peeling off in large flakes. *Wood* dark reddish-brown, hard, close-grained. *Pores* moderate-sized, enclosed in rings of pale loose tissue which run together into irregular patches and then again spread concentrically into irregular belts. *Medullary rays* fine, prominent, not numerous.

Moist low country of Ceylon.

A rather rare tree. Trimen says that it gives a good varnish resin, and that the seeds are roasted and eaten.

Ceylon: Int. Exhn., 1862—Kew Museum.

4. HOPEA, Roxb.

Eleven species, of which four from South India, four from Burma, and three from Ceylon. *H. racophlœa*, Dyer in Fl. Br. Ind. i. 310 (*H.* sp. Bedd. Fl. Sylv. xxvii.; *H. malabarica*, Bedd. Ic. Pl. Ind. Or. 42, t. 185); Vern. *Kallu*, Mal.; *Karung kongu*, Tam.; *Neduváli kongu*, Trav. Hills, is a tree of the forests of the Wynaad, common on the Carcoor Ghát, with a dark-coloured bark which peels off and hangs in long shreds on the trunk, and a deep red, hard, heavy, durable timber, likely to be useful for engineering purposes. It extends south to Travancore. *H. discolor*, Thw., Vern. *Malmora*, Cingh.; *H. jucunda*, Thw., Vern. *Pini-beraliya*, *rat-beraliya*, Cingh.; and *H. cordifolia*, Trim., Vern. *Mendora*, Cingh., are rare endemic large Ceylon trees. *H. oblongifolia*, Dyer; *H. Helferi*, Brandis, and *H. Griffithii*, Kurz, are trees of Mergui.

Wood yellow, yellowish-brown or brown, hard, smooth, even-grained, seasons well. *Pores* small to large, ringed. *Medullary rays* uniform, fine or moderately broad.

1. **H. Wightiana,** Wall.; Fl. Br. Ind. i. 309; Bedd. Fl. Sylv. t. 96; Talbot Bomb. List 18. Vern. *Kalbow, kiralboghi, haiga*, Kan.; *Kavsi*, Mar.; *Ilapongu*, Trav. Hills.

A large tree. *Wood* brown, hard and close-grained, smooth. *Pores* moderate-sized, surrounded by a white ring, resinous, often grouped 2 or 3 together. *Medullary rays* white, distinct, uniform, fine,

moderately numerous. Concentric white lines resembling annual rings.

Western coast forests, from the Konkan to Tinnevelly.

This tree is, according to Beddome, common in many of the evergreen forests on the west coast, and is noticeable for the curious echinate galls common in the axils of the leaves and on the inflorescence. The wood is an excellent fuel and affords a valuable timber, said to be the best of the timbers of Tinnevelly.

		lbs.
W 4280.	Tinnevelly (Brasier)	54

2. **H. parviflora,** Bedd. Fl. Sylv. t. 7; Fl. Br. Ind. i. 308. Vern. *Kongu*, Tam.; *Kiralboghi, tirpu*, Kan.; *Thambagam, kambagam; irubogam*, Mal.

A large tree. *Wood* brown, hard and close-grained. *Pores* small and moderate-sized, numerous, ringed. *Medullary rays* moderately broad, prominent, generally bent where they touch the pores, uniform and equidistant.

Western moist zone: Malabar and South Kanara up to 3500 ft.; Travancore and Tinnevelly.

A handsome tree with a beautiful wood somewhat like but smoother than Sál; it is but little known, though valued in South Kanara for building temples. It might be useful for sleepers. H. H. O'Connell's experiments with Tinnevelly wood gave weight 64 lbs.; our specimens give weight 60 lbs.

The following is an abstract of F. Foulkes' notes on this tree (published Mangalore, August, 1895):—

" A very large handsome tall tree with small leaves; straight growing; when young 'has a cone-shaped crown. Found either (1) in dense moist evergreen forests, or (2) as 'the remains of former patches in open plains; a strong shade-endurer. Prefers rich 'deep moist soil, growing best on river-banks and in moist valleys, but will thrive even on 'dry hard laterite, which it prefers to gneiss. Has a long deep tap-root with only few 'lateral shoots. Flowers January, February and early March, the fruit ripening in 'May; seed abundant and annual, germinates easily, but quickly loses vitality; heavy 'seed crops about every three years. Reproduces naturally, better than any S. Kanara 'species except *Xylia*; light requires to be let in after third year. Broad-cast sowing 'is generally successful, especially along river-banks. If planted, requires great care 'as it does not stand careless handling. Gives logs of large size, average 25 ft. long, '45 cubic feet; is locally considered by the people the best of timbers, and is now, 'consequently, more difficult to procure than formerly. Is used in shipbuilding, for 'road-rammers and rice-mills. Is not eaten by white ants."

		lbs.
W 745, 759.	South Kanara (Cherry)	62 and 63
W 4530.	Travancore (Bourdillon)	54

3. **H. glabra,** W. and A.; Fl. Br. Ind. i. 309. *H. Wightiana*, var. *glabra*, Bedd. Fl. Sylv. t. 96. Vern. *Kong*, Tinnevelly.

A large tree. *Wood* brown, hard, rather rough. *Pores* small, ringed, single or in patches or in roughly concentric lines. *Medullary rays* fine, long, numerous, the distance between them about equal to the diameter of the pores.

Forests of the Tinnevelly Ghâts and of Travancore, on the banks of the Periyar and Colatoor rivers.

The wood resembles that of *H. Wightiana*, and seems likely to be valuable. Bourdillon gives weight 68 lbs., P = 857.

		lbs.
W 4671.	Travancore (Bourdillon)	60

4. **H. odorata,** Roxb. Fl. Ind. ii. 609; Fl. Br. Ind. i. 308; Kurz For. Fl. i. 120. *H. eglandulosa*, Roxb. Fl. Ind. ii. 611. Vern. *Thingan*, Burm.; *Rímdá*, And.

A large evergreen tree. *Bark* ½ in. thick, dark, with deep longitudinal furrows. *Wood* yellow or yellowish-brown, hard, close and

even-grained. ***Pores*** **moderate-sized and large, rather scanty, ringed.** ***Medullary rays*** **short, moderately broad, with a few intermediate fine rays, very prominent, joined by very numerous but very faint, pale transverse lines. The rays are visible on a radial section as long straight bands, giving the wood a beautiful silver-grain.**

Tropical moist forest of Burma, not gregarious; not in Upper Burma except Pyinmana; Andaman Islands.

A beautiful and valuable wood, durable and capable of resisting white ants and other xylophagous insects. The timber pieces run up to 60 ft. in length and $2\frac{1}{2}$ ft. siding.

The weight and transverse strength have been determined by the following experiments :—

	Wt. in lbs.	Value of P.
Baker in 1829, 4 experiments with Tavoy wood 7′ × 2″ × 2″, gave	51	839
Skinner in 1862, No. 80, Burma wood, gave	45	706
Bennett in 1872, No. 5, 3 experiments with Andaman wood 3′ × $1\frac{1}{4}$″ × $1\frac{1}{4}$″, gave .	58	711
Wallich, experiments with Martaban wood, gave	39	—
Brandis in 1862, No. 14, experiments with Burma wood, gave	46	—
Smythies in 1878, 8 experiments with Burma and Andaman wood, gave . . .	50	—

The wood is very durable, *e.g.* the specimens brought by Wallich from Tavoy in 1828, which, though 50 years old when cut up in 1878, are perfectly sound and good. Boats made of it are said to last 20 years. It is the chief timber tree of Southern Tenasserim. It is used for house-building and canoes; also considered good for solid cart-wheels. In the Andamans it gives squares up to 40 ft. long with 2 ft. siding, and is reputed good for ships' blocks, bits and capstan bars, for carriage and boat building (Heinig). It gives a yellow resin, which, according to Major Protheroe, is used by the Andamanese, mixed with beeswax and red ochre, to make a wax used to fasten their spear and arrowheads. The resin is that known as "rock dammar," and is classed by merchants as a copal, and used in coach-building varnish and for mounting microscopic objects.

An analysis of the ash of *Thingan* wood and bark made by R. Romanis (Ind. Forester, xii. 73) gave—

	Sapwood.	Heartwood.	Bark.
Potash	45·62	29·64	9·72
Soda	0·94	0·37	—
Lime	24·39	44·30	64·90
Magnesia	12·62	18·49	5·50
Oxide of iron	2·61	2·23	Not determined.
Phosphoric acid	8·91	1·97	
Sulphuric acid	1·71	0·80	
Silicic acid	3·20	2·20	

		lbs.
B 282, 285.	Burma (1867)	44
B 546.	Martaban (Seaton)	53
B 2509.	Burma (Brandis, 1862)	43
B 2698.	Tavoy (Wallich, 1828)	52
B 2714.	„ „ „	49
B 2716.	„ „ „	56
B 511.	Andaman Islands (Genl. Barwell)	51
B 2201.	„ „ (Col. Ford, 1866)	54

Nordlinger's Sections, vol. 9 (Tab. II. 2).

B 3702; Vern. ***Thin-gan-shwé,*** **Burm., said, in the Burma Forest Report for 1880–81, to be found in narrow belts along streams, and to be of great value for boat hulls, is probably this species.**

5. PENTACME, A. DC.

1. **P. suavis**, A. DC; Brandis Journ. Linn. Soc. xxxi. 72. *P. siamensis*, Kurz For. Fl. i. 119. *Shorea siamensis*, Miq.; Fl. Br. Ind. i. 304. Vern. *Ingyin*, Burm.

A large deciduous, often gregarious tree. *Bark* ½ in. thick, dark grey, with deep vertical fissures. *Wood* very hard, very heavy and cross-grained; in this respect similar to Sál, which it also resembles in colour. *Pores* moderate-sized, rarely large, sometimes in groups and filled with resin, enclosed in narrow white rings and joined by fine, wavy, concentric lines. *Medullary rays* fine, numerous, equidistant.

Eng forests of Burma; also in the Shan Hills Terai at 2000 ft.; very common in the Shan States (Aplin), and in Upper Burma generally.

Weight: Brandis' Burma List of 1862, No. 16, gives 55 lbs.; the specimens average 54 lbs. The wood is much prized on account of its durability; it is used for house-building, bows and other purposes. It resembles Sál in the peculiarity that on the vertical section it has alternate belts in which the grain changes, so that a very sharp plane indeed is required to smooth it. It gives a red resin.

		lbs.
B 2507.	Burma (Brandis, 1862)	48
B 3127.	Kya-eng, Attaran Valley, Burma	69
B 2972.	Prome, Burma	46

Nordlinger's Sections, vol. 4 (*Hopea suavis*, Wall.).

6. SHOREA*, Roxb.

Twelve species, five of which are endemic Ceylon trees, three are found in Burma, two in South India, one in Assam, and one, the well-known Sál, in Northern and Central India. Of the Ceylon species, the only one which is at all common is *S. oblongifolia*, Thw.; Fl. Br. Ind. i. 307; Trimen Fl. Ceyl. i. 116; Vern. *Dún*, Cingh., found in the moist low country, and resembling *S. Tumbuggaia*, Roxb. *S. floribunda*, Kurz For. Fl. i. 119, and *S. gratissima*, Dyer Fl. Br. Ind. i. 307 (*Hopea gratissima*, Wall.; Kurz i. 121), are trees of Tenasserim.

Wood generally cross-grained, heartwood brown, hard or very hard. *Pores* moderate-sized to large, generally filled with resin, in patches or rings of light-coloured tissue. *Medullary rays* fine, broad, equidistant.

1. **S. robusta**, Gaertn. f.; Fl. Br. Ind. i. 306; Roxb. Fl. Ind. ii. 615; Bedd. Fl. Sylv. t. 4; Brandis For. Fl. 26; Kurz For. Fl. i, 119; Gamble Darj. List 9. The Sál tree. Vern. *Sál*, *sála*, *salwa*, *sákhu*, *sakher*, Hind.; *Shál*, *kandár*, Garhwal; *Sakwa*, Nep.; *Teturl*, *takral*, Lepcha; *Bolsal*, Gáro; *Jargi*, Khond; *Sarjúm*, Kól; *Sargi*, Bhumij; *Sakwa*, Kharwar; *Sekwa*, Oraon; *Shal*, Beng.; *Salwa*, *soringhi*, Uriya; *Sarái*, Rewah; *Guggilapu*, Palkonda; *Koroh*, Oudh; *Sarei*, *rinjal*, C.P.; *Gúgal*, Tel.

A large gregarious tree, never quite leafless. *Bark* of young trees smooth, with a few long, deep, vertical cracks; of old trees 1 to 2 in. thick, dark coloured, rough, with deep longitudinal furrows. *Wood*: sapwood small, whitish, not durable; heartwood brown, pale when first cut, but darkening on exposure, coarse-grained, hard, with a remarkably fibrous and cross-grained structure; the fibres of alternate belts in the wood on a vertical section running in opposite directions, so that when the wood is dressed a very sharp plane is necessary or it will not get smooth; does not season well. *Annual rings* only visible in young trees or on freshly cut wood. *Pores* moderate-sized to large, often filled with resin; each pore or group of pores in a patch of pale, loose tissue. *Medullary rays* uniform, moderately broad,

straight, very prominent, joined by short white transverse lines, the distance between the medullary rays equal to the transverse diameter of the pores. Silver-grain rather pretty from the dark colour of the medullary rays.

The Sál tree occupies two principal regions in India. The first is a belt at the foot of the Himalaya and running into its valleys and up its lower hills to 3000 or 4000 ft., and exceptionally, as for instance at Lansdowne, to a still higher altitude. According to J. E. T. Aitchison ("Flora of Hoshiarpur," *Journ. Linn. Soc.*, 1868), the Purwain Range is the western limit. Brandis says it occurs in patches on the Bias. It is found in the Kangra valley, and the regular continuous forest commences in the Ambála Siwaliks west of the Jumna, whence it passes through Dehra Dún, Saharanpur, Bijnor, Kumaon, Oudh, Gorakhpur, Nepal, the Darjeeling Terai, W. and E. Dúars, and up the Assam valley, with an outlier in the Garo Hills. The second is the Central Indian belt, and the Sál country begins on the Ganges near Rajmehal and passes through the Sonthal Parganas, Rewah, Chota Nagpore, the Central Provinces, Orissa and the Northern Circars, ending in the Palkonda range of Vizagapatam and the forests of Jeypur.

The most uniformly gregarious among the timber trees of India, the Sál, in the forests in which it occurs, is always the prevailing tree, greater in number of individuals than all the rest put together. Brandis (*Journ. Linn. Soc.*, xxxi. 6) says regarding it, "In a climate and on soil which suit it, it reigns supreme. The most suitable soil is 'either sandstone, as in many parts of Central India, or alternating beds of shingle and 'sand, such as are found at the foot of the Himalaya, or loam resting on gravel and sand. 'The principal factors which enable it to maintain the upper hand over its associates 'in a climate and on soil suitable to its development, may briefly be stated as follows: 'The seed ripens at the right season of the year, at the commencement of the rains; '. . . it is produced in great abundance and germinates readily; the leaves of the 'seedling plants are very large, thus choking other trees and shrubs which may have 'sprung up with them; . . . it stands much shade when young, and remains alive 'for years under cover of tall grass, bushes or other trees." Years of exceptional seed-production occur about once in three, and the amount of seed then given is enormous. The seedlings which spring up so quickly as quickly again disappear from view the next hot season: some die outright from the effects of frost; the tops of some get burnt by the sun, for the Sál tree is, when young, very sensitive to too great exposure and cannot resist frost; some succumb to fire if the area is not protected; few only and quite exceptionally grow on direct into trees. The fact is that, until the roots have gone down sufficiently far to reach a permanently moist stratum of soil, this yearly dying off regularly takes place, but eventually the time does come when the moisture is reached, and a stronger and finer shoot is put out capable of growing and becoming a tree. Sál also coppices very readily, and its coppice shoots in suitable localities grow very strong and thick and reach a considerable height in very few years. In those valuable forests in the different provinces of India in which fire-protection has become an assured thing over, at any rate, a very large percentage of the area, the growth of Sál has been most satisfactory, and the tendency to form a thick crop, to the exclusion of grasses and weeds and shrubs, has been most marked. Especially is this the case in forests which have been worked with a view to helping the Sál to hold its own and more, as in forests which, like those of Dehra Dún, have been for some years under a system of improvement designed to replace badly-grown trees by well-grown ones, to increase the proportion of Sál and its more valuable allies by clearing the kinds of less value, and to reduce the danger of fire by killing off the grass. Blanks in the forest, where the soil is suitable, gradually fill up by the growth of young trees at the edges, where they find some protection against sun and frost, but the process is very slow.

As regards the size which the Sál is capable of reaching, Brandis (For. Fl. 27) says, "In the gorges at the foot of the hills in the Nepal Terai, the Sál tree attains 100 to '150 ft., with a clear stem to the first branch of 60 to 80 ft., and a girth of 20 to 25 ft. 'But such dimensions are exceptional; as a rule it attains 60 to 80 ft., with clear stems '30 to 40 ft. long and a girth of 6 to 8 ft." The largest tree I can remember was one in the valley of the Great Rangit, in the Darjeeling Hills, which was 161 ft. high, 86 ft. to the first branch, and 10 ft. 8 in. in girth at 4 ft. from the ground.

As regards the rate of growth of Sál, much depends, of course, upon climate and soil. As explained in the first edition of this work, the results of experiments in Assam

A SÁL FOREST IN THE DEHRA DÚN.

process of seasoning it dries with great rapidity on the surface, while beneath it remains as wet as when first cut, and evaporation goes on afterwards with extreme slowness. The effect of this peculiarity is to cover the surface all over with superficial flaws from unequal shrinkage. With proper precautions, however, it can be made to dry slowly, and under these circumstances it has been found by numerous experiments that the ratio of drying is $\frac{3}{4}$ of an inch annually all round the piece of wood. Sál, when once thoroughly seasoned, stands almost without a rival, as a timber, for strength, elasticity and durability, which qualities it retains without being sensibly affected, for an immense length of time.

Numerous varieties of Sál timber are supposed to exist. Mr. Clifford, in the pamphlet above quoted, says, "There are two descriptions of Sál brought to Calcutta; 'they are known as 'Morung' and 'Durbhunga;' one from the forests to the east of 'the Coosi, the other from the forests to the west. The Morung Sál is the best; it is 'very straight-grained, clean and free from knots; it seasons more kindly, and is 'stronger than the Durbhungah Sál; only a practised eye can distinguish one Sál from 'the other." Many of these supposed varieties, however, exist in imagination only, *e.g.* of the two Buxa pieces E 3137 and E 3138, the Nepalese sawyers say that one is a softer and redder wood than the other, but I can distinguish no such difference between them.

Sál is the timber which in Northern India is the most extensively used. It is in constant request for piles, beams, planking and railing of bridges; for beams, door and window-posts of houses; for gun-carriages; the body of carts (not the wheels, for which it is unsuited, and for which Sissú or even Saj is better); and above all, for railway sleepers, the yearly consumption of which reaches some lakhs of cubic feet. It is used, or used to be used, in the hills of Northern Bengal, where it is found, perhaps, of the largest size now available, for making canoes. Owing to its not being floatable, difficulty is experienced in those Sál forests which are in the hills, in getting the timber out of the forest in log. The difficulty is, however, partially overcome by floating the logs either with the assistance of boats or with floats of bamboos or light woods, such as Semul (*Bombax malabaricum*).

An analysis of the ashes of 100 lbs. steam dry wood made at the Imperial Forest School, Dehra Dún, gave 0·46 lb. of ash, the composition of which was—

	lbs.
Soluble potassium and sodium compounds	4·35
Phosphate of iron, calcium, etc.	4·35
Calcium carbonate	52·20
Magnesium carbonate	34·80
Silica sand and impurities	4·30
	100·00

As regards calorific power, Dr. Leather found in the wood, moisture 5·75, carbon 91·10, ash 3·15 per cent., and that the calorific power of the wood was 88·8 compared with pure carbon 100. He found that 1 lb. of wood evaporated 13·32 lbs. water at 210° Fahr.

When tapped, the tree exudes large quantities of a whitish, aromatic, transparent resin (*lál dhúna*), which is collected and sold. It is used to caulk boats and ships and as incense. In some places in the Upper Tista forests of the Darjeeling District, large pieces, often 30 to 40 cub. in. in size, are found in the ground at the foot of the trees. Large extents of forest, chiefly in Central India, such as Chota Nagpore, the Central Provinces and the country between the Mahanadi and Godavari, have been ruined by this practice of tapping the trees to obtain the resin. The seed is eaten by the Southals, especially in time of scarcity; it is roasted, and is usually eaten mixed with the flowers of the Mohwa (*Bassia latifolia*). Sál butter is the oil from the cotyledon of the seed, which is boiled and the grease skimmed off. It sets hard and white in cold weather, and is used for cooking and lighting. In the famine of 1897, Sál seeds were in considerable demand as an article of food.

Sál leaves are but little eaten by cattle, except in the very young stage, when the new pink leaves, especially of coppice shoots, are apt to be browsed.

In the last few years experiments have been started to ascertain how far the large amount of tannin known to exist in Sál bark could be separated as a tannin extract, and what would be its value as a tanning material for export.

The Sál has many enemies. The chief insect enemy is probably *Plocederus obesus*,

Dap., a Cerambycid beetle which makes big galleries in the wood, passing its pupal stage in a solid egg-like cocoon. *Hoplocerambyx spinicornis*, Newn., is very destructive to Sál timber in sleepers in Singbhúm. *Cœlosterna scabrata*, Fabr., the Sál girdler, is another Cerambycid which girdles Sál shoots and lays its eggs on the twig above the girdle. *Chrysobothrys sexnotata*, Gory, is a Buprestid beetle which bores holes in dry or girdled Sál and sometimes does great damage. The Tusser silkworm (*Antheræa paphia*, Linn.) feeds on the Sál as well as upon other trees. *Dasychira Thwaitesii*, Moore, is a moth belonging to the family Lymantriidæ which has been known to do very serious damage to Sál trees in the Goalpara District of Assam, as reported by W. R. Fisher and T. J. Campbell (see "Ind. Forester," vi. 243, and xx. 256) in 1894 and 1898. *Leucoma diaphana*, Moore, has been found as a defoliator at Dubri. *Clania variegata*, Snell = *Eumeta Sikkima*, Moore, is a Psychid or bagworm moth which badly defoliates Sál in N. Bengal. Of fungoid enemies, perhaps the most important is *Meliola amphitricha*, Fr., a sooty black Perisporiaceous mildew which covers the leaves often over large areas, and must greatly interfere with their transpiration. Trees attacked by it have a black appearance.

		lbs.
O 204.	Garhwal (1868)	53
O 2990.	„ (1874)	59
O 4574.	18 years as a beam in a house at Dehra Dún, N.W.P. (C. W. Hope)	51
O 4933.	Post 40 years in a torrent crossing the Ganges canal at Pathri, near Hardwar (Grenfell)	49
O 873.	Ramganga Valley, Kumaon, 1800 ft. (Capt. Campbell)	69
O 386, 387, 388, 390.	Oudh (Wood)	60
O 1215.	Oudh (Wood)	59
O 2980.	„ *(section of fire-damaged tree) (Wood)*	—
O 1210, 1211.	Oudh (sapling sections) (Wood)	—
O 1213.	Oudh (sections of shoot) „	—
O 1214.	„ (butt ends) „	—
C 173.	Mandla, C. P. (1871)	49
C 3434, 3440, 3441, 3444.	Palamow Forests, Bengal (Gamble)	—
C 3650, 3651.	Koderma Forest, Hazaribagh (Gamble, 1882)	—
C 3472, 3473, 3478, 3479, 3480.	Saranda Forest, Singbhúm (Gamble)	—
C 3490.	Kolhán Forests, Singbhúm (Gamble, 1882)	—
C 3556, 3516.	Khurdha Forests, Orissa (Gamble)	48
C 3825, 4000.	Gumsúr Forests, N. Circars „	54
C 1235.	Gumsúr, N. Circars (Dampier)	64
E 497.	Sukna Hills, Darjeeling, 1500 ft. (Manson)	58
E 702.	Tista Valley „ „ „	64
E 2322.	Darjeeling Terai (Gamble)	54
E 3137, 3138.	Buxa Reserve, Western Dúars (Richardson)	62 and 61
E 3385.	Berhampore Forest, Rungpore, Bengal	80
E 3616, 3618.	Bamunpokri Forest, Darjeeling, 1000 ft.	—
E 3624–3630.	Dulka Jhar, Darjeeling Terai	57
E 3589, 3617.	Sivoke Forest, Darjeeling Terai	47
E 3390.	Dhupguri, W. Dúars, Bengal (Gamble)	—
E 635.	Eastern Dúars, Assam (Mann)	53
E 1440.	Mishmi Hills (Griffith, 1836)	47
	Nordlinger's Sections, vol. 5 (Tab. II. 3).	

(The identification of No. E 1440 is doubtful; the pores are not filled with resin, and the medullary rays are finer and more numerous than in Sál.)

2. **S. Tumbuggaia**, Roxb. Fl. Ind. ii. 617; Fl. Br. Ind. i. 306; Bedd. Fl. Sylv. xxvi. t. 5. Vern. *Cangu, congo, tambugai, tambagum*, Tam.; *Thambá, googgilapukarra*, Tel.

A large tree. *Bark* dark, rough, with deep vertical fissures like that of Sál. *Wood* smooth, harder than that of Sál, but similar in structure and much smoother. *Pores* moderate-sized to large, ringed. *Medullary rays* shorter and somewhat unequal. Concentric lines more numerous and more distinctly marked.

South Deccan, in the Cuddapah and North Arcot Districts.

This tree has but a small area of distribution: it is not entirely gregarious, but in places patches of it are found of considerable extent, and it then much resembles the groves of Sál of North and Central India. After the Red Sanders, it is the most valuable and useful tree of the Cuddapah Forests, and is especially in demand of small size for house-posts.

Weight: Baker gives 68 lbs.; Skinner, No. 133, 58; while the specimens give 69 lbs. Baker gives P varying from 902 to 996; Skinner, 980. It is also, probably, Skinner's No. 137 "Congoe"; weight 64 lbs., P = 982. The wood is used for house-building, particularly for door frames and posts and for rafters; also for plough-handles. It gives a dammar, which is used as a substitute for pitch and for burning in temples.

		lbs.
D 1062.	Cuddapah Forests (Beddome)	66
D 1078.	North Arcot " "	68
D 4069 and D 4201.	Cuddapah Forests (Higgens)	75 and 67
D 3894.	Ballipalle Forests, Cuddapah (Gamble)	70

3. **S. obtusa,** Wall.: Fl. Br. Ind. i. 306; Kurz For. Fl. i. 118. Vern. *Thitya*, Burm.

A large tree. *Bark* ½ inch thick, grey, with deep longitudinal fissures. *Wood* the colour of Sál, very hard and durable. *Pores* moderate-sized to large, often filled with resin; each pore surrounded by a narrow pale ring. *Medullary rays* moderately broad to broad, numerous, joined by short irregular transverse bars or lines of lighter-coloured tissue. The wood of this tree is more even-grained than that of Sál.

Eng forests of Burma, up to 2000 ft., and as far north as Shwebo.

Weight: according to Skinner, No. 115, 58 lbs.; Brandis' Burma List of 1862, No. 17, gives 57 lbs.; the specimens vary from 52 to 67 lbs., averaging 60 lbs. Skinner gives P = 730. The wood is much valued on account of its durability; it is used for canoes and in building, also for tool-handles and planes. It gives a white resin.

		lbs.
B 555, 556.	Prome, Burma (Ribbentrop)	64 and 67
B 2973.	" "	52
B 283.	Burma (1867)	56

4. **S. Talura,** Roxb. Fl. Ind. ii. 618; Fl. Br. Ind. i. 304; Talbot Bomb. List 18. *S. laccifera*, Heyne; Bedd. Fl. Sylv. t. 6. Vern. *Talura, talári*, Tam.; *Jalári*, Tel.; *Jálá*, Coorg; *Jalaranda*, Kan.

A large tree. *Bark* grey, with longitudinal fissures. *Wood* yellow or yellowish-brown or grey, hard, smooth, with small dark-coloured irregularly-shaped heartwood. *Pores* small and moderate-sized, scanty, resinous, ringed, single or in short patches, and joined by fine transverse bars. No distinct *annual rings*, but alternating belts, with numerous and with few pores. *Medullary rays* fine to moderately broad, numerous.

Sirsi talúq of N. Kanara, Mysore, the S. Deccan districts of Madras, in Cuddapah, N. Arcot, and Anantapur, up to 3000 ft.; Wynaad, Malabar, Coimbatore, and Madura.

This handsome tree is only found sporadically, chiefly in hilly country; the wood more resembles that of *Hopea* than that of Sál and *Thambá*. Weight: Puckle gives 43 lbs. per cubic foot; the specimens give 48 to 70 lbs., a rather wide range. Puckle finds P = 896. The wood is much used for house-building, and is largely sent down to Madras for that purpose.

		lbs.
D 1056.	South Arcot Forests (Beddome)	70
D 1092.	Madura " "	65

D 1092 has a smooth, yellow, even-grained wood, while D 1056 is grey with a dark brownish-red heartwood, but the structure of the two is identical.

		lbs.
D 3895.	Horsleykonda, Cuddapah, 3000 ft. (Gamble)	48
D 4066.	Cuddapah Forests (Higgens)	52

5. **S. assamica,** Dyer in Fl. Br. Ind. i. 307. Vern. *Makai*, Ass.

A very large gregarious tree. *Bark* brown, rough. *Wood* light brown, soft, open-grained. *Pores* large, ringed, single or in groups or short oblique lines. *Medullary rays* rather few, fine to moderately broad, the distance between them equal to or less than the diameter of the pores.

Upper Assam, at the foot of the Naga Hills in the Sibsagar and Lakhimpur Districts.

A very fine tree, but the wood is, though structurally similar, softer and different in appearance to that of the other species. S. E. Peal says, "A good sample of 'Makai forest is a grand sight, with the leaf canopy up so high, and there being often 'so few small trees or foliage below. The enormous stems rise all around and are easily 'seen" (*Ind. Tea Gaz.*). Chev. Paganini says, "Its gregarious tendency forms an 'exception to all other Assam trees [he probably omits reference to Sál]: in some 'places the forest is almost exclusively constituted by Makai trees" (*Timber Trades Journal*). Mann says the wood is used for planking and canoes. Peal recommends its much extended use for tea-boxes, and considers that one good tree might give 350 boxes valued at Rs.200. Paganini states that he has used the wood for bridges near Margarita, where pieces 60 ft. long and 8 ft. in girth were required. He advises its use for sleepers after it has been "pickled" with crude petroleum. Growth, 5 rings per inch of radius.

Like the Sál, this tree is often attacked by the Cerambycid borer *Pachydissus holosericeus*, Fabr., which does very serious damage; the leaves are often eaten, as are those of Sál, by the moth *Dasychira Thwaitesii*, Moore.

		lbs.
E 3369.	Makúm, Assam (Mann)	—
E 4698.	Dibrugarh, Assam (H. C. Hill, 1896)	36

7. PARASHOREA, Kurz.

1. **P. stellata,** Kurz For Fl. i. 117. *Shorea stellata*, Dyer in Fl. Br. Ind. i. 304. Vern. *Kaunghmu, thingadu*, Burm.; *Panthitya*, Tavoy.

A very large evergreen tree. *Bark* ½ inch thick, dark brown, longitudinally fissured. *Wood* yellowish-brown, moderately hard. *Pores* round, moderate-sized to large, single or in small groups, often filled with a resinous substance; each pore enclosed in a narrow pale ring. *Medullary rays* moderately broad; the distance between two rays generally equal to the transverse diameter of the pores.

Burma: eastern slopes of Pegu Yoma, up to 1500 ft.; tropical forests of Martaban. Weight, 47 to 50 lbs. The wood is used for canoes and in boat-building.

		lbs.
B 1944.	Tavoy, Burma (Col. Seaton)	47
B 2481.	Tenasserim	50
B 4071.	Tavoy (Palmer)	47

8. BALANOCARPUS, Bedd. Three species. *B. zeylanicus*, Trimen Fl. Ceyl. i. 130, t. 14, is a small, rare tree, endemic in Ceylon. *B. utilis*, Bedd. Fl. Sylv. ccxxxvii. t. 330 (*Hopea longifolia*, Dyer in Fl. Br. Ind. i. 309); Vern. *Kara kong*, Tinnevelly, is

a large tree of the Tinnevelly Hills, south of Courtallum, at 1–3000 ft., with a valuable timber. *B. erosa*, Bedd. Fl. Sylv. ccxxxvii. t. 329, is also a large tree of the Tinnevelly Hills at 2–3000 ft.

TRIBE III. VATICEÆ.

9. COTYLELOBIUM, Pierre. *C. scabriusculum*, Brandis (*Vatica scabriuscula*, Dyer in Fl. Br. Ind. i. 303. *Sunaptea scabriuscula*, Trimen Fl. Ceyl. i. 126, t. 12); Vern. *Namendora*, Cingh., is a large tree, endemic in the moist low country of Ceylon.

10. VATICA, Linn.

Eight species. *V. obscura*, Trimen Fl. Ceyl. i. 129, t. 13; Vern. *Tumpalai*, Tam., is a large gregarious tree forming forests on low river-banks in the Eastern Province of Ceylon, with a hard heavy brown wood weighing 80 lbs. per cubic foot, and a sticky gum resin used as a dammar for boats. *V. affinis*, Thw.; Fl. Br. Ind. i. 303; Trimen Fl. Ceyl. i. 128; Vern. *Hal-mendora*, Cingh., is another endemic large tree of the low country in Ceylon. *V. Griffithii*, Brandis in Jour. Linn. Soc. xxxi. 121, is a tree of Mogoung in Upper Burma. *V. grandiflora*, Dyer in Fl. Br. Ind. i. 301 (*Anisoptera odorata*, Kurz For. Fl. i. 112, is a moderate-sized tree of Martaban and Tenasserim. *V. faginea*, Dyer in Fl. Br. Ind. i. 301, is also a Tenasserim tree, perhaps not distinct from the last. *V. scaphula*, Dyer in Fl. Br. Ind. i. 301 (*Hopea scaphula*, Roxb. Fl. Ind. ii. 611; Kurz For. Fl. i. 121); Vern. *Boilshora*, Magh., is a tree of Mascal Island, Chittagong, with "a trunk so immensely large as to be made into canoes" (Roxb.).

1. **V. chinensis**, Linn. *V. Roxburghiana*, Bl.; Fl. Br. Ind. i. 302; Bedd. Fl. Sylv. t. 95; Trimen Fl. Ceyl. i. 128. Vern. *Cheru piney*, Mal.; *Vellei payin*, Trav. Hills; *Mendora*, Cingh.

A large tree. *Wood* reddish-brown, hard, close-grained. *Pores* small to moderate-sized, ringed, disposed in irregular slanting lines and fairly regularly between the fine numerous *medullary rays* which touch them. *Annual rings* indistinct.

Evergreen forests of South Kanara, Malabar and Travancore; moist low country near streams in Ceylon.

A handsome tree with a useful wood. Growth fast, about 5 rings per inch of radius.

The experiments made by Prof. W. C. Unwin, F.R.S., for the Imperial Institute, on Ceylon woods, gave the following results (*Imp. Inst. Jour.*, May, 1899):—

Weight	59·70 lbs. per cubic foot.
Resistance to shearing along the fibres	620·4 lbs. per square inch.
Crushing stress	2·619 tons „ „
Coefficient of transverse strength	6·125 „ „ „
Coefficient of elasticity	835·4 „ „ „

	lbs.
W 4729. Travancore (Bourdillon)	59

No. 34, Ceylon Collection, new (Mendis): Vern. *Gal-mendora*, Cingh., agrees with this species. He says it is "the best wood for underground purposes." W = 57 lbs., P = 370.

2. **V. lanceæfolia**, Bl.; Fl. Br. Ind. i. 302; Kurz For. Fl. i. 122; Roxb. Fl. Ind. ii. 601. Vern. *Morhal*, Ass.; *Moal*, Sylhet; *Panthitya*, Burm.

A moderate-sized tree. *Bark* smooth, thin, grey. *Wood* red, moderately hard. *Pores* small to moderate-sized, scanty, usually subdivided. *Medullary rays* fine, moderately numerous, bent round

the pores. The wood resembles that of *Meliaceæ*, or of *Pentace* in *Tiliaceæ*.

Assam valley and surrounding hills, up to 2000 ft.; Cachar, Chittagong and Burma.

Brandis says this is "a large shrub, sometimes growing into a tree." S. E. Peal says that the wood is pleasant to work, makes good planking and excellent charcoal. If this is Skinner's No. 131 (*Vateria lanceæfolia*, Roxb.; Vern. *Let-touk*, Burm.), the weight is 58 lbs. and P = 931; Wallich gives 54 lbs., the specimen 35 lbs. Kurz says that the tree gives a strong-smelling balsam, the *Ghúnd* of the Brahmins.

	lbs.
B 2508. Burma (Brandis, 1862)	35

Tribe IV. VATERIEÆ.

11. STEMONOPORUS, Thw. A genus of endemic Ceylon trees, 15 in number, all more or less scarce. It is made a section of *Vateria* in the Fl. Br. Ind. *S. Wightii*, Thw.; Trimen Fl. Ceyl. i. 132 (*Vateria ceylanica*, Wight; Fl. Br. Ind. i. 314); Vern. *Halmendora*, Cingh., a large tree of the moist low country, is the principal species.

12. MONOPORANDRA, Thw. Another endemic Ceylon genus containing two rather scarce trees, *M. cordifolia*, Thw. and *M. elegans*, Thw.; Trimen Fl. Ceyl. i. 137, 138.

13. VATERIA, Linn.

Two species. *V. acuminata*, Heyne; Fl. Br. Ind. i. 313; Trimen Fl. Ceyl. i. 131 *V. indica*, L.; Bedd. Fl. Sylv. xxvii.) Vern. *Hal*, Cingh., is a beautiful tree of the oist low country of Ceylon, giving a light, rather hard, yellowish-grey wood, weighing) to 42 lbs. per cubic foot (F. Lewis), and a clear yellowish resin, said to be equal to ie best dammar.

1. **V. indica**, Linn.; Fl. Br. Ind. i. 313; Roxb. Fl. Ind. ii. 602; Talbot Bomb. st 18. *V. malabarica*, Blume; Bedd. Fl. Sylv. t. 84. The Piney Varnish or idian Copal Tree. Vern. *Piney maram, dhup maram, vallay kungiliam, kondricam*, im.; *Dupa maram, dhupa, paini, manda dhup, illupathla, gugle*, Kan.; *Dupada*, el.; *Payani, paini maru, perum piney, vella kondrikam*, Mal.; *Hal*, Cingh.

A large evergreen tree. *Bark* whitish-grey, rough, $\frac{3}{8}$ in. thick, eeling off in round thick flakes. Sapwood white with a tinge of rey or red; heartwood light grey, rough, moderately hard, porous. *ores* large, often subdivided, ringed. *Medullary rays* fine and road, very prominent on all vertical sections, while on a radial ction they appear as rough plates with white shining fibres between iem. The distance between the broad rays is generally greater than ie transverse diameter of the pores. *Annual rings* doubtful, though istinct.

Evergreen forests at the foot of the Western Ghâts from Kanara to Travancore, cending to 4000 ft.; often planted as an avenue tree.

Of this tree Beddome says, "It is one of the handsomest trees in the Madras Presidency; it is common in all the western forests from the plains up to 4000 ft., and is extensively planted as an avenue tree, particularly near the coast in South Kanara, Malabar and Travancore; the avenue of it at Karkul in S. Kanara is a beautiful sight. It flowers in January." The wood is not much in request; it is ccasionally used for canoes, for coffins, and the masts of native vessels. Mendis says iat it is a "first-class timber for tea-chests, packing-cases, ceilings, coffins, etc.," but is wood specimen does not look as if it were so good. Bourdillon gives weight 36 lbs. = 415; the specimens give 40 lbs.

It gives the piney gum resin, which makes an excellent varnish resembling copal. full account of this, by Mr. Broughton, Government Quinologist, is given in Bedd.

Fl. Sylv. J. H. Brougham, writing to me in 1885, reported that the resin was mixed with cocoanut oil and rolled into candles, which burn with a dark heavy smoke. The seeds give a kind of tallow called "piney tallow," or vegetable butter, there being as much as 50 per cent. of the tallow in the seeds. Candles made of the tallow burn well, but are too soft. There is very little trade in the substance, which is still, therefore, a product to which attention deserves to be paid. The collection of seeds from avenue trees should be easy and remunerative.

		lbs.
W 747.	South Kanara (Cherry)	41
W 1187.	„ „	41
W 4317.	„ „	40
W 4306.	Malabar	51 wet
W 4586.	Travancore (Bourdillon)	39
No. 43, Ceylon Collection, new (Mendis)		26

Nordlinger's Sections, vol. 10 (Tab. II. 4).

ORDER XVIII. ANCISTROCLADEÆ.

1. ANCISTROCLADUS, Wall. Straggling or climbing shrubs, of which six species are enumerated in the Fl. Br. Ind. *A. Vahlii*, Arn.; Fl. Br. Ind. i. 299; Trimen Fl. Ceyl. i. 139, t. 16; Vern. *Gonawel*, Cingh., is found in the moist region of Ceylon, and has very long leaves. *A. Heyneanus*, Wall.; Fl. Br. Ind. i. 299; Talbot Bomb. List 17; Vern. *Kardor*, *kardul*, Mar., is found on the Western Ghâts. The rest of the species are found in Burma: of these *A. Griffithii*, Planch.; Fl. Br. Ind. i. 300; Kurz For. Fl. i. 110; Vern. *Panben*, Burm., is found in the swamp forests; and *A. Wallichii*, Planch., in the tropical forests, extending to Chittagong and the Andamans.

ORDER XIX. MALVACEÆ.

An Order in which in India about 22 genera are found, mostly herbs or small under-shrubs, with nine genera of trees or large shrubs. Few of them are valuable for their timber, though the wood of *Bombax malabaricum* is extensively used for temporary constructions and boxes. Many are valuable for their fibres, and particularly *Adansonia* and *Hibiscus*. The cotton plants, species of *Gossypium*, belong to this family; only one species of the genus, *G. Stocksii*, Masters, a straggling shrub found in the plains near Karachi on the coast of Sind, being indigenous in India.

Adansonia digitata, Linn.; Fl. Br. Ind. i. 348; Roxb. Fl. Ind. iii. 164; Beddome Fl. Sylv. xxix.; Brandis For. Fl. 30; the Baobab tree; Vern. *Gorak imli*, Hind.; *Gorak chinch*, Guz.; *Kalp briksh*, Ajmere, Delhi; *Paparapulia*, Tam., was introduced from tropical Africa, and is now cultivated here and there, chiefly in South India and Bengal, but occasionally as far north as Gurgaon (see "Indian Forester," vol. iv. p. 202, for description of a tree at Tilpat, measuring 22 ft. in girth and rising 50 ft. to the first branch). Brandis mentions three trees at Deogarh in the Central Provinces, respectively measuring 16, 22, and 40 ft. in girth, and there are one or two good-sized trees at Calcutta and Barrackpore. A tree at Puttalam, in Ceylon, is mentioned by Emerson Tennent (ii. 627) as being 70 ft. in height and 46 ft. in girth. It has since been destroyed. In Ind. Forester xxiv. 327 is given a picture by Mr. C. Bagshawe of a Baobab tree at Karwand, Buldana District, 42 ft. in girth, "the biggest tree in Berar." Dr. T. Cooke mentions an historical tree at Bijapur, in the Mahratta country. It has been experimentally planted at Calcutta and in the Sundarbans, as, were it capable of easy cultivation, its rapid growth, valuable fibre and fruit would make the extension of its growth desirable; as yet, however, it has not succeeded.

The nine genera belong to two Tribes, viz.—

Tribe I. Hibisceæ	Julostyles, Dicellostyles, Hibiscus, Thespesia.
„ II. Bombaceæ	Kydia, Bombax, Eriodendron, Cullenia, Durio.

Wood generally soft, a few species, like *Thespesia populnea*, with small dark-coloured heartwood. *Pores* moderate-sized to large. *Medullary rays* fine or moderately broad. *Kydia calycina*, *Hibiscus syriacus* and *Cullenia excelsa* have faint concentric lines.

1. JULOSTYLES, Thw. *J. angustifolia*, Thw.; Fl. Br. Ind. i. 333; Bedd. Fl. Sylv. xxix.; Trimen Fl. Ceyl. i. 150, is a slender tree endemic in the moist low country of Ceylon.

2. DICELLOSTYLES, Bth. Two species. *D. jujubifolia*, Bth.; Fl. Br. Ind. i. 333; Gamble Darj. List 10; Vern. *Kubindé*, Nep.; *Dantagla*, Lepcha; is a small white-flowered tree of the hills of Sikkim and Bhutan. *D. axillaris*, Bth.; Fl. Br. Ind. i. 333; Bedd. Fl. Sylv. xxix.; Trimen Fl. Ceyl. i. 150, is a moderate-sized tree of Ceylon found near Badulla at 2000 ft.

3. HIBISCUS, Medik.

A genus of herbs, shrubs, climbers or small trees. The ten Indian woody species consist of three small trees, two shrubs, one climber, and four introduced garden shrubs. *H. fragrans*, Roxb. Fl. Ind. iii. 195; Fl. Br. Ind. i. 337; Vern. *Kinárlur*, Beng., is a small tree of Assam and Cachar. *H. scandens*, Roxb. Fl. Ind. iii. 200; Fl. Br. Ind. i. 337; Kurz For. Fl. i. 127; Gamble Darj. List 10, is a large climbing shrub of Eastern Bengal from Sikkim to Chittagong; and *H. collinus*, Roxb. Fl. Ind. iii. 198; Fl. Br. Ind. i. 338; Talbot Bomb. List 19; Vern. *Kandagang*, Tel., a large shrub of the Eastern Madras coast. *H. rosa-sinensis*, Linn.; the Shoe plant; Vern. *Juwa, oru*, Beng.; *Daswála*, Kan.; *Kaungyan*, Burm., with brilliant, large red flowers; *H. tricuspis*, Banks; *H. mutabilis*, Linn.; and *H. syriaçus*, Linn.; Vern. *Gurhul*, are all shrubs which have been introduced and are now cultivated in gardens. *H. Sabdariffa*, L. is the "Roselle" of Indian gardens.

1. **H. furcatus**, Roxb. Fl. Ind. iii. 204; Fl. Br. Ind. i. 335; Talbot Bomb. List 19; Trimen Fl. Ceyl. i. 152. Vern. *Napiritta*, Cingh.

A large shrub. *Bark* grey, shining, fibrous, dotted with prominent brown lenticels. *Wood* white, moderately hard. *Pores* few, often subdivided, or in close groups. *Medullary rays* fine and moderately broad, short, irregular.

Forest undergrowth throughout India and Ceylon, not very common. It gives an excellent fibre.

W 4260. Nilgiris, 6000 ft. (Gamble).

2. **H. macrophyllus**, Roxb.; Fl. Br. Ind. i. 337; Kurz For. Fl. i. 126 (*H. setosus*, Roxb. Fl. Ind. iii. 194). Vern. *Kachia udal, kasyapála*, Beng.; *Máoh*, Gáro; *Sho, dayban*, Magh; *Yetwun*, Burm.

A small tree. *Bark* ¼ in. thick, light brown, fibrous, rather smooth. Sapwood white; heartwood light purplish-brown, soft, even-grained. *Pores* moderate-sized, scanty, often subdivided. *Medullary rays* fine but clearly marked, unequally distributed, short. *Annual rings* marked by fewer pores in the autumn wood. A well-marked silver-grain.

Eastern Bengal, Chittagong and Burma.

A pretty tree with large hispid leaves, said to give a useful wood and a good rope-making fibre. Wallich gives the weight 27 to 28 lbs. per cubic foot; the specimen examined gives 37 lbs.

	lbs.
E 3289. Rinkheong Reserve, Chittagong (Gamble)	37

3. **H. tiliaceus**, Linn.; Fl. Br. Ind. i. 343; Roxb. Fl. Ind. iii. 192; Bedd. Fl. Sylv. xxix.; Kurz For. Fl. i. 126; Talbot Bomb. List 19; Trimen Fl. Ceyl. i. 157.

H. tortuosus, Roxb. Fl. Ind. iii. 192. Vern. *Bola, chelwa*, Beng.; *Thinban*, Burm.; *Beligobel, bellipatta*, Cingh.

A small tree. *Bark* grey, inner bark fibrous. *Wood* soft, grey, heartwood purplish. *Pores* very numerous, small and moderate-sized, often subdivided. *Medullary rays* fine and moderately broad, not very prominent.

Sea-coast forests and along tidal rivers all round India, Burma and Ceylon, sometimes a tree, more usually a much-branching shrub.

This very common coast plant is useful for fuel, and occasionally for hut-building, and perhaps for catamarans, though Heinig mentions it as "injurious to forest growth." Sebert, in "Les bois de la nouvelle Calédonie," says it is used in Tahiti for planking and building light boats. Darwin has called attention to its use in the same island for rubbing to procure fire. The fibre of the bark is extensively used in Bengal for making rough ropes; it is readily separated, and ought to be useful for paper-making; it has the advantage of not easily getting rotten under water. In Ceylon it is used for mats. In the Sundarbans it gives a strong fibre used for cordage.

	lbs.
E 405. Sundarbans (Richardson)	35
Ceylon Collection, No. 7, old; No. 11, new (Mendis)	38

H. syriacus has a white *wood*, soft, even-grained. *Pores* small and moderate-sized, sometimes subdivided, more numerous in the spring wood, where they mark two annual rings. *Medullary rays* fine, short, distinct. Faint, close, even, white concentric lines very numerous. Cellular tissue irregular. (Nordlinger's Sections, vol. 2.)

H. mutabilis also has a white soft *wood*. *Pores* moderate-sized, single or subdivided into 2 to 6, between the *medullary rays*, in radial lines. *Medullary rays* fine, numerous. No faint concentric lines as in *H. syriacus*. Cellular tissue regular, cells rectangular. (Nordlinger's Sections, vol. 9.)

4. THESPESIA, Corr.

Two species. *Th. Lampas*, Dalz. and Gibs.; Fl. Br. Ind. i. 345; Kurz For. Fl. i. 128; Gamble Darj. List 10; Talbot Bomb. List 19; Trimen Fl. Ceyl. i. 158 (*Hibiscus Lampas*, Cav. and *H. tetralocularis*, Roxb. Fl. Ind. iii. 197, 198); Vern. *Ranbhendy*, Mar.; *Bankapsi*, Sonthal; *Ban kapasha*, Mal Pahari; *Bonkapash*, Ass. (Wallich); *Kaphalmúk*, Lepcha; *Kondapatli*, Tel., is a conspicuous under-shrub of Sál and other forests, chiefly deciduous, throughout India, Burma and Ceylon. It has large yellow flowers with a purple centre. According to Kyd, the weight of the wood is 29 lbs and P = 407, but, though Brandis speaks of it as a small tree, and Trimen says "or 'very small tree," I, who have observed it in hundreds of places, have never seen it even really woody, so that I doubt the identity of Kyd's specimens.

1. Th. populnea, Corr.; Fl. Br. Ind. i. 345; Bedd. Fl. Sylv. t. 63; Kurz For. Fl. i. 128; Talbot Bomb. List 19; Trimen Fl. Ceyl. i. 158. *Hibiscus populneus*, Willd. Roxb. Fl. Ind. iii. 190. The Portia tree or Tulip tree. Vern. *Parsipu*, Hind.; *Poresh, parash, dumbla*, Beng.; *Poris, purasia, portia, pursa, pursung, puvarasam, kavarachu, puvarachu*, Tam.; *Gangareni, gangaraya*, Tel.; *Bhendi*, Mar.; *Bendi*, Guz.; *Asha hurvashi*, Kan.; *Bugári*, Hassan; *Suriya*, Cingh.

A moderate-sized, evergreen tree. Sapwood soft, heartwood hard dark red, smooth. *Pores* moderate-sized, scanty, subdivided, uniformly distributed. *Medullary rays* fine, uniform, the distance between two rays generally equal to the transverse diameter of the pores.

Coast forests of India, Burma and Ceylon; more often cultivated in towns near the sea-coast, as at Calcutta, Madras, Bombay and Colombo, as an avenue tree. In the Sundarbans it is found chiefly west of the Raimangal river.

The wood is durable; it is used in South India for gunstocks, boats, cart and carriage making, and for furniture (Beddome); in Bombay for wheel-spokes (Gleadow), in Burma for furniture and carts (Kurz). The weight, according to Skinner, No. 130, and A. Mendis, is 49 lbs.; Sébert (New Caledonia) gives 42 lbs.; the specimens give 50 lbs. Skinner gives P = 716, A. Mendis 708. The bark gives a good fibre, and a

yellow dye very like gamboge is obtained from the capsules, which often contain small masses of it (Gleadow).

The experiments made by Prof. W. C. Unwin, F.R.S., for the Imperial Institute, on Ceylon woods, gave the following results (*Imp. Inst. Journ.*, May, 1899):—

Weight	50·33	lbs. per cubic foot.
Resistance to shearing along the fibres	926·9	lbs. per square inch.
Crushing stress	2·818	tons „ „
Coefficient of transverse strength	5·206	„ „ „
Coefficient of elasticity	452·6	„ „ „

	lbs.
C 1050. Guzerat (Shuttleworth)	50
E 2488. Calcutta (King)	—
B 2470. Andaman Islands (Kurz, 1866)	—
Nos. 28, 51, Salem Collection	53 and 48
No. 80, Ceylon Collection, old; No. 127, new (Mendis)	49

5. KYDIA, Roxb.

Two species. *K. glabrescens*, Mast.; Fl. Br. Ind. i. 348, is a tree of Bhutan and Assam.

1. **K. calycina,** Roxb. Fl. Ind. iii. 188; Fl. Br. Ind. i. 348; Bedd. Fl. Sylv. xxviii.; Brandis For. Fl. 29; Kurz For. Fl. i. 124; Gamble Darj. List 10; Talbot Bomb. List 20. *Kydia fraterna*, Roxb. Fl. Ind. iii. 189. Vern. *Pola, púla, púli, patha, potári, choupultea*, Hind.; *Barranga, bhoti*, C.P.; *Kakahi*, Oudh; *Kubindé*, Nep.; *Sedangtagla, tagla*, Lepcha; *Mahow, moshungon*, Mechi; *Boldobak*, Gáro; *Kopásia*, Uriya; *Potri, pandiki, peddapotri, pedda kunji, kondapatti*, Tel.; *Buruk, bosha*, Gondi; *Bendi, bende-naru, bellaka*, Kan.; *Wárang, iliya, rán-bhendi*, Mar.; *Bitha gonyer*, Kól; *Derhi*, Kharwar; *Wala*, Khond; *Pulan*, Jeypore; *Puska olat*, Sonthal; *Bothi*, Melghát; *Dwalôk, tabo, myethlwa*, Burm.

A small or moderate-sized tree. *Bark* ¼ in. thick, grey, peels off in irregular flakes. *Wood* white, soft; heartwood grey. *Annual rings* marked by white lines. *Pores* scanty, moderate-sized, often oval and subdivided. *Medullary rays* short, fine to broad, numerous, joined by white transverse bars, caused by faint concentric lines, and in this respect resembling Anonaceæ, except that they are irregular and wavy; on a radial section distinctly visible as long straight bands, giving a marked silver-grain.

In forests throughout India and Burma, chiefly in the deciduous forests, and not in the arid region. Common in the sub-Himalayan tract.

The wood is of little value and rarely used, though Brandis and Beddome write of it as used in building, etc. A bad fuel, dry wood burning with an unpleasant smell. The bark gives a fibre which might be used for rough ropes or paper stock; it also is used to clarify sugar (Brandis). The growth is very fast, and in coppice woods it might easily, if not kept down, supplant better kinds, as may be seen in the Dehra Dún. Weight 36 lbs.; Brandis says 40 to 45 lbs.

	lbs.
C 1177. Ahiri Reserve, C.P. (R. Thompson)	37
C 1163. „ „ „ „	33
O 3154. Saharanpur Forests (Grenfell)	45
H 4428. Kalsi Forest, Jaunsar, N.W.P. (Moir)	30
W 4183. Mudumalai Forest, Nilgiris, 3000 ft. (Gamble)	40

6. BOMBAX, Linn.

Three species, all large trees with whorled branches, large flowers, and capsular fruit with much cotton.

Wood white, soft. *Pores* large, scanty. *Medullary rays* broad, silver-grain good.

1. B. malabaricum, DC; Fl. Br. Ind. i. 349; Bedd. Fl. Sylv. t. 82; Brandis For. Fl. 31; Kurz For. Fl. i. 130; Gamble Darj. List 10; Talbot Bomb. List 20; Trimen Fl. Ceyl. i. 160. *B. heptaphyllum*, Cav.; Roxb. Fl. Ind. iii. 167. The Cotton tree. Vern. *Simbal*, Hazara; *Shirlan*, Sutlej; *Shimlo*, Kumaon; *Shimal*, Garhwal; *Semul*, *shembal*, *semur*, *pagun*, *somr*, Hind., Beng.; *Bouro*, *buroh*, Uriya; *Bolchú*, *panchú*, Gáro; *Sunglú*, *tunglu*, Lepcha; *Simal*, *saodi*, Melghat; *Khatsawar*, Bassim; *Kamba*, Khond; *Buroh*, Saora; *Wuraga*, Palkonda; *Edel*, Sonthal; *Dél*, Kól; *Simur*, Mal Pahari; *Búrga*, *búrgú*, *búraga*, Tel.; *Sayar*, Mar.; *Sawar*, Guz.; *Illavam*, *púla*, *parutti*, Tam.; *Burla*, *sauri*, *buruga*, Kan.; *Walliaki*, Gondi; *Katseori*, Bhíl; *Lapaing*, Magh; *Ilavu*, Mal.; *Letpan*, Burm.; *Katu-imbul*, Cingh.

A very large deciduous tree, with branches in whorls, spreading horizontally, and stem with buttresses at base. *Bark* grey, when young with conical prickles with corky base, when old with long, irregular, vertical cracks. *Wood* white when fresh cut, turning dark on exposure, very soft, perishable; no heartwood; no annual rings. *Pores* very scanty, very large, often oval or divided into compartments. *Medullary rays* fine to broad, numerous, not prominent. Pores and silver-grain prominent on a vertical section.

Throughout India, Burma and Ceylon, from the Indus eastwards and southwards, ascending to 3000 ft., occasionally higher. Often cultivated.

The Cotton tree chiefly prefers the deciduous forests, but may be found in others in suitable places; it is common in grass lands, and is conspicuous on hot hillsides. It often grows to a very large size—witness the Seraidih tree in Palamow (V. Ball, "Jungle Life in India," p. 652; Gamble, "Ind. Forester," vii. 296), which was 135 ft. high and 115 ft. in girth round buttresses. The growth is very fast, commonly about 4 to 5 rings per inch of radius, but often faster; S. E. Peal, in "Ind. Forester," ix. 539, describes a tree felled in Assam which had 16 annular rings on 21 in. radius. The tree gave 150 cub. ft. of timber, which cut up into about 2000 sup. ft. of planking.

Weight: 23 to 24 lbs. according to Brandis For. Fl., 28 lbs. Burma List of 1862, No. 5; the specimens vary from 17 to 32 lbs., the average being nearly 23 lbs., the Bengal and Assam specimens being lighter than those from the Central Provinces. Bourdillon makes it 29 lbs. The value of P is between 642 and 697 (Cunningham); Bourdillon gives 519. The wood is not durable, except under water, when it lasts tolerably well; it is used for planking, packing-cases and tea-boxes, toys, scabbards, fishing floats, coffins and the lining of wells. If allowed to dry in the log the wood gets discoloured, so that to ensure white planking the tree should be sawn up at once and the planks dried separately. In Bombay, Bengal and Burma the trunk is often hollowed out to make canoes. It gives a brown gum used in native medicine, regarding which Captain Campbell says: "The collection of Semul gum commences in March, and is 'continued till June; it sells in the Kumaon Bhabar at one anna per seer, and is used 'as a medicine; it is not exported from Kumaon." Baden-Powell (Ind. For. viii. 153) gives a detailed and interesting account of the formation of this *mócharas* gum, which he considers due to some functional disease. The cotton which surrounds the seeds is employed to stuff pillows and quilts.

Mr. Romanis' analysis of the ash of wood from Burma gave as follows (we quote only the heartwood, as there is so little distinction in Semul between heartwood and sapwood) (see Ind. For. xii. 73):—

Potash	36·47	The ash being 1·75 per cent. of the wood.
Soda	0·77	
Lime	23·80	
Magnesia	23·41	
Oxide of iron	1·24	
Phosphoric acid	9·36	
Sulphuric acid	1·16	
Silicic acid	3·60	

Dr. Warth's analysis at Dehra gave 4·33 lbs. of ash out of 100 lbs. steam-dry wood (= 80 lbs. air-dry), and of this soluble potassium and sodium compounds gave 3·94, phosphates of iron, calcium, etc., 38·12; calcium carbonate, 18·26; magnesium carbonate, 38·12; and silica sand, etc., 1·56 per cent.

The Semul tree seeds very freely every year, and seedlings come up abundantly and grow very rapidly. It is easily reproduced by cuttings. The leaves are not eaten by goats.

It is frequently attacked by the Cerambycid beetle, *Plocederus obesus*, Dap., as well as by another large Cerambycid, called by R. Thompson *Monochamus soongna*, Thompson. The cotton pods are often badly damaged by the Noctuid moth, *Mudaria cornifrons*, Moore. Tea-box wood at Calicut has been found much damaged by a boring beetle, *Bostrychus æqualis*, Wat. (see fig. in "Ind. Mus. Notes," v. 34).

		lbs.
P 466.	Ajmere	—
C 201.	Mandla, Central Provinces (1871)	32
C 1117.	Chanda (R. Thompson)	31
E 679.	Bamunpokri, Darjeeling Terai (Manson)	23
E 2323.	" " " (Gamble)	17
E 1232.	Sibságar, Assam (Mann)	28
E 1432.	Assam (Mann)	20
E 1961.	Chittagong (Chester)	21
E 3606.	Sivoke Forests, Darjeeling Terai (Gamble)	—
E 3676.	Darjeeling Terai (Gamble)	19
B 3117.	Burma (Brandis, 1862)	24
No. 14, Salem Collection		20
No. 67, Ceylon Collection, new (Mendis) (*Bombax ceiba*)		—

Nordlinger's Sections, vol. 11.

2. B. insigne, Wall.; Fl. Br. Ind. i. 349; Kurz For. Fl. i. 130; Talbot Bomb. List 21. Vern. *Semul, thula*, Beng.; *Saitu*, Magh; *Didu*, Burm.

A large tree, trunk without prickles. *Wood* structure similar to that of *B. malabaricum*, but *pores* smaller and more scanty.

Deciduous forests of N. Kanara; Chittagong; Burma, in the upper mixed forests of the Pegu Yoma, up to 3000 ft., first found by Wallich in dry ravines near Yenangheen; Andaman Islands.

The wood is more durable than that of ordinary Semul; one specimen had been 12 years in Calcutta in the rough, and the wood was only slightly discoloured when cut up. In the Andamans it squares up to 45 ft. with 2½ ft. siding (Heinig).

		lbs.
B 2215.	Andaman Islands (Col. Ford, 1866)	31

3. B. cambodiense, Pierre Fl. For. de la Cochinchine t. 174. Vern. *Kôkhe*, Burm.

A large tree, 60 to 80 feet high, with greyish trunk, studded with strong conical spines. *Wood* similar to that of *B. malabaricum*, with *pores* perhaps slightly larger and rather wider *medullary rays*, giving a better silver-grain.

Forests of Upper Burma.

The wood is better than that of *B. malabaricum*, it is used in Burma for making packing-cases (J. W. Oliver).

		lbs.
B 4749.	Upper Burma (Nisbet)	25

7. ERIODENDRON, DC.

1. E. anfractuosum, DC; Fl. Br. Ind. 350; Bedd. Fl. Sylv. xxx.; Talbot Bomb. List 21; Trimen Fl. Ceyl. i. 161. *E. orientale*, Steud.; Kurz For Fl. i. 131. *Bombax pentandrum*, Roxb. Fl. Ind. iii. 165. The White Cotton tree. Vern. *Safed simal, senibal, katan, hatian*, Hind.; *Shevet simúl*, Beng.; *Shamieula, katsawar*, Mar.; *Ilavam*, Tam.; *Buruga, pur, kadami*, Tel.; *Dúdi mara*, Kan.; *Pania*, Mal.; *Imbúl, pulun imbúl*, Cingh.

A moderate-sized tree. *Bark* greyish-brown, green when young, peeling off in round bosses. *Wood* yellowish or brownish white, soft.

Pores very large, very scanty, often subdivided. *Medullary rays* fine, the distance between them less than the diameter of the pores. A good silver-grain.

May be indigenous on the Western Coast and at the Straits; it is doubtfully so in Burma or Ceylon, and Kurz says he only saw one tree wild in the coast forests of S. Andaman (it may itself have come from a sea-borne seed). Largely planted about villages and temples in all the coast region, and in Burma. Dr. T. Cooke mentions it as wild in Khandésh.

The wood is of poorer quality than that of Semul. Kurz says it is good for toys. Its chief use is for the cotton (*kapok*) given by the fruit (not from the testa of the seed, but from the wall of the capsule (Trimen)), which is of better quality than the cotton given by *Bombax*, as it is more elastic, and when used for pillows and cushions, less liable to go into knots. It is, however, not much utilized in British India, the chief supply and the chief demand being from Java and other parts of Netherlands India, whence in 1885 the exports amounted to about 600 tons. Skinner, No. 67, gives the weight of the wood at 30 lbs. and P = 400. It gives a bright resinous gum. The tree is grown from cuttings, and used as a support for the betel vine in *Areca* plantations in Mysore (Graham Anderson).

	lbs.
W 4307. South Kanara	28

8. CULLENIA, Wight.

1. **C. excelsa,** Wight; Fl. Br. Ind. i. 350; Bedd. Fl. Sylv. xxx.; Trimen Fl. Ceyl. i. 162. The Wild Durian. Vern. *Malai-konji, aini-pillao, vedupla,* Tam.; *Katu-boda, kabodda,* Cingh.; *Karáni,* Kader; *Kar ayani,* Trav. Hills.

A large tree. *Bark* smooth, grey. *Wood* pink to reddish-brown, soft to moderately hard. *Pores* small, scanty. *Medullary rays* fine, numerous, red, equidistant. Numerous faint, brown parallel bands concentrically disposed, somewhat as in *Kydia*. The longitudinal section resembles that of *Calophyllum*.

Forests of the Western Gháts in Coorg, Wynaad, Nilgiris, Malabar, the Anamalai Hills and Travancore, up to 4000 ft.; moist region of Ceylon.

Beddome calls this a gigantic tree, in which I concur, but Trimen speaks of it only as moderate-sized or large. It has a large (4 to 6 in.) globose prickly fruit, which when fallen is rather troublesome in the forest to native workers with bare feet; it is not edible like the Durian. The wood seems good, and likely to be valuable for planking and boxes. It was well spoken of from Tinnevelly. Bourdillon gives weight 34 lbs., P = 308, but says the wood is worthless. The leaves are densely scaly, and have a coppery appearance; they resemble those of the Durian.

	lbs.
W 3899, 4291. Tinnevelly (Brasier)	43
W 4604. Travancore (Bourdillon)	31

9. DURIO, Linn.

1. **D. zibethinus,** DC; Fl. Br. Ind. i. 351; Roxb. Fl. Ind. iii. 399; Kurz For. Fl. i. 132. The Durian. Vern. *Duyin,* Burm.

An evergreen tree. *Bark* grey, smooth, except for a few vertical clefts and horizontal wrinkles. *Wood* pale reddish-brown, soft. *Pores* large, scanty, often subdivided. *Medullary rays* moderately broad, numerous, giving a well-marked silver-grain.

Wild and forming forests in Lower Tenasserim from 14° N. lat. southwards; cultivated in Upper Tenasserim (Kurz).

The "Durian" tree produces the well-known strong-smelling, very thorny fruit in the Malay regions, but it is little known in India. A good account of it is given in Wallace's "Malay Archipelago," vol. i. 74–76. Dr. Wallace himself so much

appreciated it that he says "as producing a food of the most exquisite flavour it is 'unsurpassed.'" However excellent it may be to eat, it is certainly endowed with a most disagreeable smell, and I noticed in Java that, although commonly sold in the bazaar, it was rarely eaten by Europeans.

		lbs.
B 5074.	Thaungyin, Burma (Cappel)	35

ORDER XX. STERCULIACEÆ.

This Order contains 15 Indian genera of herbs, shrubs, climbers or trees. Of these genera three have only herbs or (*Melhania*) under-shrubs, and the rest shrubs, climbers or trees. They are mostly fibre-yielders and mucilaginous.

The Cocoa plant, *Theobroma Cacao*, Linn., belongs to this Order, and is grown in suitable places in S. India and Ceylon. It has a grey, soft, perishable *wood*, with scanty *pores*, often subdivided; and *medullary rays* of two classes, few broad, and many fine between them, bent round the pores (Nordlinger's Sections, vol. 8). The Cola nut, *Cola acuminata*, Schott and Endl., is a tree of West Africa, especially Sierra Leone. The nut has a bitter taste, and, like the leaves of the Coca (*Erythroxylon Coca*), it has the power of staying the cravings of hunger and enabling fatigue to be endured.

The Order is divided into 6 Tribes with 13 genera.

Tribe I. Sterculieæ . .	Sterculia, Heritiera.
„ II. Helictereæ . .	Reevesia, Kleinhovia, Helicteres, Pterospermum.
„ III. Eriolæneæ . .	Eriolæna.
„ IV. Dombeyeæ . .	Melhania.
„ V. Hermannieæ .	Melochia.
„ VI. Buettnerieæ . .	Abroma, Guazuma, Buettneria, Leptonychia.

Wood structure various. *Heritiera* has a hard heavy wood; *Pterospermum* and *Eriolæna* moderately heavy furniture woods; *Sterculia* a soft and light wood. *Pores* rather scanty, often large. *Medullary rays* rather numerous. Concentric bands in some species.

1. STERCULIA, Linn.

About twenty-one species, mostly from Eastern Bengal and Burma.

S. versicolor, Wall.; Fl. Br. Ind. i. 355; Kurz For. Fl. i. 135; Vern. *Shaw byu*, Burm., is a large tree of the drier forests of Pegu. *S. Roxburghii*, Wall.; Fl. Br. Ind. i. 356; Gamble Darj. List 11, is a tree of the North-East Himalaya and Assam, ascending to 6000 ft. *S. Balanghas*, Linn.; Fl. Br. Ind. i. 358; Bedd. Fl. Sylv. xxxii.; Trimen Fl. Ceyl. i. 165 (*S. angustifolia*, Roxb. Fl. Ind. iii. 148; Kurz For. Fl. i. 138); Vern. *Cavalum*, Mal.; *Nava*, Cingh., is a moderate-sized tree of the West Coast and the low country of Ceylon. *S. scaphigera*, Wall.; Vern. *Thibyu*, Burm.; and *S. campanulata*, Wall., are large trees of the tropical forests of Burma. *S. cognata*, Prain Journ. As. Soc. Beng. lxvii. ii. 2, 285, is a tree of the Kachin Hills of Upper Burma.

Wood generally light, soft, often spongy. *Pores* large. *Medullary rays* moderately broad or broad, very prominent on a radial section.

1. **S. fœtida**, Linn.; Fl. Br. Ind. i. 354; Roxb. Fl. Ind. iii. 155; Bedd. Fl. Sylv. xxxi.; Kurz For. Fl. i. 135; Talbot Bomb. List 22; Trimen Fl. Ceyl. i. 164. Vern. *Jangli-badam*, Hind.; *Pinári*, Tam.; *Gurapu-badam*, Tel.; *Letkop*, Burm.; *Telambu*, Cingh.

A large tree. *Bark* thick, whitish. *Wood* grey, spongy, soft, but harder and firmer than that of *S. villosa*, which it resembles. *Pores* moderate-sized, often subdivided. *Medullary rays* broad, short, pale, joined by numerous transverse bars.

West Coast of India; Martaban and Upper Tenasserim in Burma; low country of Ceylon; often cultivated.

This tree is remarkable for the disgusting odour of its flowers, which appear when the tree is leafless; and for its seeds, which are roasted and eaten. The wood is of no value: according to Skinner, No. 118, its weight is 28 lbs. and P = 464.

		lbs.
E 3708.	Royal Bot. Garden, Calcutta (King, 1881)	29
D 4138.	A.-H. Gardens, Madras (Steavenson)	45 (wet)
No. 136,	Ceylon Collection, new (Mendis), a poor specimen	26

2. S. urens, Roxb. Fl. Ind. iii. 145; Fl. Br. Ind. i. 355; Bedd. Fl. Sylv. xxxii.; Brandis For. Fl. 33; Kurz For. Fl. 135; Talbot Bomb. List 22; Trimen Fl. Ceyl. i. 164. Vern. *Gúlú, kúlú, gular, tabsi, tanuku, karrai,* Hind.; *Katira,* Garhwal; *Odla, hatchanda,* Ass.; *Tabsu, yerra polki,* Tel.; *Vellay pútali, kavali,* Tam. *Hittúm, pinoh,* Gondi; *Takli,* Kurku; *Karai, kandol, saldawar, gwira,* Mar.; *Kalru,* Ajmere; *Kalauri,* Panch Mehals; *Karái, taklej, kúlú, gúrú, kairu,* Berar; *Kurr,* Merwara; *Kaddu, karr,* Jeypore; *Keonge,* Manbhúm: *Teley,* Kól; *Mogul, karaunji,* Monghyr; *Khonji,* Koderma; *Kodaro,* Uriya; *Genduli,* Khond.

A large deciduous tree. *Bark* ½ in. thick, very smooth, white or greenish-grey, exfoliating in large thin irregular papery flakes. *Wood* very soft, reddish-brown, with an unpleasant smell, with lighter coloured sapwood, always feels wet or oily. *Pores* large, often oval and subdivided, very scanty, frequently filled with gum. *Medullary rays* moderately broad, on a radial section prominent as long, dark undulating bands, giving the wood a mottled silver-grain; the distance between the rays is larger than the transverse diameter of the pores. Alternate dark and light concentric bands across the rays.

Dry forests of N. India extending west to the Ganges; throughout Central India and the Deccan, chiefly on dry stony hills; common on the West Coast in the Konkan and Kanara; dry forests in Burma and Ceylon, scarce in the latter.

This tree is always conspicuous, especially in the hot season, from its light-coloured smooth bark. It is quite characteristic of dry rocky hills and plateaux, in company with *Boswellia serrata,* and useful in reclothing such places with forest.

Weight about 42 lbs. per cubic foot; Kyd gives for Assam wood: Weight 18 lbs. P = 103, but it seems probable that Kyd's specimen was not this, but *S. villosa.*

The wood is used to make native guitars and toys. It yields a gum called "*katila*" or "*katira.*" The seeds are roasted and eaten by Gonds and Kurkus in the Central Provinces. Its bark gives a good fibre.

		lbs.
P 471.	Ajmere	35
P 3220.	Nagpahar, Ajmere	—
C 1102.	Ahiri, Central Provinces (R. Thompson)	39
D 1088.	Madura, Madras (Beddome)	51
C 3436.	Kumandi Reserve, Palamow (Gamble)	—

3. S. villosa, Roxb. Fl. Ind. iii. 153; Fl. Br. Ind. i. 355; Bedd. Fl. Sylv. xxxii.; Brandis For. Fl. 32, t. 10; Kurz For. Fl. i. 136; Gamble Darj. List 10; Talbot Bomb. List 22. Vern. *Poshwa,* Sutlej; *Udal, udar, odal, odála,* Hind.; *Gul-bodla, gul-kandar, massu,* Punjab; *Godgudala,* Dehra Dún; *Fudalu,* Kumaon; *Udalu,* Garhwal; *Udália,* Dotial; *Kanhlyem,* Lepcha; *Kúdar, baringa,* Gondi; *Buti,* Kurku; *Omak, odela, salua,* Ass.; *Udare,* Gáro; *Vake nar, arni, ani-nar, murutthan,* Tam.; *Sambeing,* Magh.; *Kutháda, kudal,* Berar; *Sisi, walkóm,* Kól; *Pironja,* Mundari; *Sisir,* Oraon; *Udale,* Sonthal; *Sarda,* Mar.; *Savaya, kaitháli,* Kan.; *Vakka,* Mal.; *Shawni,* Burm.

A moderate-sized deciduous tree. *Bark* grey or brown, with corky warts. *Wood* greyish-brown, very soft, spongy. *Pores* large, scanty, often subdivided. *Medullary rays* harder than the spongy

tissue between them, short, giving a marked silver-grain on a radial section, on which, also, the pores are distinctly prominent.

Sub-Himalayan tract from the Indus eastwards; common in forests throughout India and Burma. Is found in the Andamans and Cocos Islands.

A conspicuous tree, with large leaves, chiefly affecting dry forests on sandy soils. Growth fast, 3 to 6 rings per inch of radius. Weight 15 to 22 lbs. per cubic foot. Wood not used. The tree is valuable on account of its fibre, which is coarse but strong, and which is made into ropes and coarse bags, and in Bengal, Burma and South India into ropes and breastbands for dragging timber. It gives a white pellucid gum which exudes copiously from cuts in the bark. Romanis' experiments in the analysis of the ash of various Burmese woods showed that in *Sterculia villosa* ash there was 57·08 per cent. of lime, 20·54 per cent. of potash, and 9·67 per cent. of magnesia. It also gave 3·02 per cent. of chlorine. All the three woods examined, this, *S. ornata* and *S. versicolor* gave a large proportion of lime, much larger than other woods (Ind. For xii. 73). The tree coppices freely, and is extremely difficult to extirpate in clearings.

		lbs.
E 2324.	Sivoke, Darjeeling Terai (Gamble)	22
E 620.	Bamunpokri, Darjeeling Terai (Bonham-Carter)	15
W 847.	South Kanara (Cherry)	20

4. **S. ornata**, Wall.; Kurz For. Fl. i. 136. *S. armata*, Mast.; Fl. Br. Ind. i. 357 *part*, *vide* King in Journ. As. Soc. Beng. lx. ii. 171. Vern. *Shawwa*, Burm.

A deciduous tree, resembling *S. villosa*. *Bark* light brown smooth, with scattered oblong vertical lenticels ¼ to ½ in. long, ¼ in. thick. *Wood* greyish-brown, very soft, spongy; structure the same as that of *S. villosa*.

Burma, apparently in deciduous forest.

		lbs.
B 5103.	Toungoo, Burma	16
B 4850.	Pyinmana, Burma (G. E. Cubitt)	15
B 5012.	Thayetmyo, Burma (Maung Oung Ban)	18

B 4856 from Yabé Reserve, Magwe (S. E. Jenkins), with white wood and shining bark, may be a specimen of this cut from a very young tree.

B 4854, called *Dônshaw* from Pyinmana (Cubitt), resembles *S. villosa* and *S. ornata* in wood, but has the bark lighter and smoother than that of the latter, and few round lenticels. I incline to put it under *villosa*.

B 5073 received from Mr. Cappel from Thaungyin, Burma, is marked *S. ornata*. It has grey shining bark, peeling off in papery layers, a white soft wood, very scanty moderate-sized pores and broad medullary rays. It is clearly a different species from B 4850 and B 5012, but I cannot identify it. The bark is like that of *S. urens*, but the wood is whiter and softer. W = 15 lbs.

5. **S. guttata**, Roxb. Fl. Ind. iii. 148; Bedd. Fl. Sylv. t. 105; Talbot Bomb. List 22; Trimen Fl. Ceyl. i. 165. Vern. *Kawili*, Kader; *Kukar, goldar, koketi*, Mar.; *Happu savaga*, Kan.; *Thondi*, Tam.; *Kavalam*, Mal.

A tree. *Wood* greyish-white, soft, light, porous. *Pores* very large, scanty, ringed. *Medullary rays* broad, not numerous, giving a good silver-grain. Transverse bars spaced, not very prominent.

Evergreen forests of the Western Coast and the hills of S. India, from the Konkan southwards.

The bark gives an excellent fibre, which is sometimes used to make rough clothing. The wood is of no value.

		lbs.
W 4677.	Travancore (Bourdillon)	15

6. **S. coccinea**, Roxb. Fl. Ind. iii. 151; Fl. Br. Ind. i. 357; Kurz For. Fl. i. 137; Gamble Darj. List 11. Vern. *Sitto udal*, Nep.; *Katior*, Lepcha.

A small evergreen tree. *Bark* smooth, light grey. *Wood* grey spongy, extremely soft. Structure similar to that of *S. urens* Transverse bars distinct.

Eastern Himalaya, ascending to 6000 ft.; Assam, Khasia Hills, hills of Burma. The bark is used for the same purposes as that of *S. villosa*, but less commonly.

		lbs.
E 573.	Khooklong Forest, Darjeeling Terai (Manson)	17

7. S. colorata, Roxb. Fl. Ind. iii. 146; Fl. Br. Ind. i. 359; Bedd. Fl. Sylv xxxii.; Brandis For. Fl. 34; Kurz For. Fl. i. 138; Gamble Darj. List. 11; Talbo Bomb. List 22; Trimen Fl. Ceyl. i. 166. Vern. *Bodula, bodala, walena, samarri* Hind.; *Moola*, Beng.; *Sitto udal, phirphiri, omra*, Nep.; *Kanhlyem*, Lepcha; *Bolazong* Gáro; *Khowsey, pinj*, Berar; *Bhái-koi*, Bombay; *Sisi*, Sonthal, Kól; *Natol*, Ma Pahari; *Mutruk*, Merwara; *Lersima*, Kharwar; *Kowsey*, Mar.; *Malai-parutti*, Tam. *Kénawila*, Vedda; *Karaká*, Tel.; *Wetshaw*, Burm.; *Berdá*, And.

A moderate-sized tree. *Bark* grey. *Wood* grey, very soft Structure similar to that of *S. urens*, but *medullary rays* broader and shorter, and transverse bars distinct.

Sub-Himalayan tract from the Jumna eastwards; Central, Western and Southern India; Burma and the Andaman and Cocos Islands; dry region of Ceylon.

The tree is remarkable for its brilliant scarlet flowers, which appear before the leaves. Growth fast, 3 to 4 rings per inch of radius.

The bark is used in rope-making.

		lbs.
E 1394.	Chittagong (Chester)	24

8. S. pallens, Wall.; Voigt Hort. Sub. Calc. 105. *S. fulgens*, Wall.; Fl. Br Ind. i. 360 (part); Gamble Darj. List 11. Vern. *Khardala*, Dehra Dún; *Kaphal*, Lepcha.

A deciduous small tree. *Bark* greyish-brown, fibrous. *Wood* greyish-white, soft. *Pores* moderate-sized to large, often subdivided. *Medullary rays* of two kinds, broad and fine, joined by prominent concentric white bands. A well-marked silver-grain.

Lower Himalaya from the Jumna to Bhutan, Siwalik Hills. Ascends to nearly 5000 ft. about Mussoorie, 3000 ft. in Sikkim.

Flowers resembling those of *S. colorata*, but yellow instead of scarlet. The roots of young trees have tubers, which are eaten by Lepchas (Darj. List).

		lbs.
O 3660.	Garhwal	31
O 4637.	Forest School Garden, Dehra Dún (Gamble)	—

9. S. alata, Roxb. Fl. Ind. iii. 152; Fl. Br. Ind. i. 360; Bedd. Fl. Sylv. xxxii.; Kurz For. Fl. i. 134; Gamble Darj. List 11; Talbot Bomb. List 22. Vern. *Tula*, Beng.; *Muslini*. Nep.; *Bara laiphanzeh*, Mechi; *Hangkyow*, Magh; *Letkôk*, Burm.; *Anei thondi, kithondi*, Tam.; *Porla*, Mal.

A tall handsome evergreen tree. *Bark* smooth, grey. *Wood* white, soft, but harder than that of most of the other species of the genus. *Pores* large, scanty, between the numerous regular, moderately broad *medullary rays*, which are of harder wood, and give a pretty silver-grain. Transverse bars numerous and fairly regular.

Evergreen forests of Northern and Eastern Bengal and Burma; Andaman and Cocos Islands; scarce in S. India, still more so in the Bombay Presidency.

An excellent avenue tree, with large cordate leaves.

		lbs.
O 4563.	Saharanpur Bot. Garden (W. Gollan)	26
W 4732.	Travancore (Bourdillon)	37

10. **S. populifolia,** Roxb. Fl. Ind. iii. 148; Fl. Br. Ind. i. 361; Bedd. Fl. Sylv. xxxii. Vern. *Dalibuda*, Tel.

A small tree. *Bark* grey, ½ in. thick, fibrous. *Wood* greyish-white, soft. *Pores* moderate-sized, scanty. *Medullary rays* broad, short. Concentric bands regular, forming a regular rectangular net-work with the medullary rays.

Hills of the Deccan from the Godavari to Mysore, usually among rocks.

The bark gives a good fibre, which is easily cleaned. The tree is easily recognized by its scarlet flowers and inflated papery capsule.

D 3891. Nigadi Forest, Cuddapah, 2500 ft. (Gamble).

2. HERITIERA, Aiton.

Five species. In the first edition of this work the *Sundri* tree of the Sundarbans was erroneously described as *H. littoralis*, Dryand. It appears now that the Sundarbans tree is *H. minor*, Roxb., and that *H. littoralis*, Dryand. of the Fl. Br. Ind. contains two if not three different species (cf. King in *Journ. As. Soc. Beng.* lx. 79). *H. macrophylla*, Wall.; Kurz For. Fl. i. 141; Hook. f. Bot. Mag. t. 7192, is a tree of Cachar and of Burma away from the coast. It is probably this tree that was examined in Kyd's experiments with Assam wood, when he found weight 67 lbs. P = 710. *H. dubia*, Wall; Prain in Ann. Calc. ix. 8, t. 11, is a tree of low elevations in the Khasia Hills.

1. **H. minor,** Lam.; Roxb. Fl. Ind. iii. 142; Kurz For. Fl. i. 141. *H. Fomes*, Buch.; Fl. Br. Ind. i. 363. Vern. *Sunder, sundri*, Beng.; *Pinlèkanazo*, Burm.

A gregarious evergreen tree. *Bark* dark grey, with longitudinal cracks. *Wood* very hard, close-grained: sapwood pale; heartwood dark red. *Pores* moderate-sized to large, often oval and subdivided into compartments. *Medullary rays* uniform, moderately broad, short, wavy; the distance between two rays being generally equal to the transverse diameter of the pores. Occasional transverse bars.

Forests of the Sundarbans, the Ganges-Brahmaputra delta, chiefly in those of the Khulna District, east of the Raimangal river; coast forests of Burma, in the Irrawaddy Delta.

The Sundri forests of the Sundarbans are among the most valuable of the Government forest properties in India. Schlich (Ind. For. i. 6) describes these forests, and explains how it is not on the front face of the forest region of the delta that Sundri occurs, but a little inland on islands which are only occasionally flooded by salt water. He describes the Sundri as a tree of up to 60 ft. in height and 6 ft. in girth, whose timber is used for many purposes (see below). At the time at which he wrote (1875), his complaint of the unrestricted cutting of young Sundri was doubtless good, but since that time various regulations culminating in Mr. Heinig's Working Plan have regulated the cutting so as to protect the young growth and ensure the permanent supply of timber suited to the demands of the market, which is that of Lower Bengal generally, but especially of Calcutta.

Weight as much as 104 lbs. when wet, according to Schlich. The weight of seasoned wood, as well as the value of P, have been determined by the following experiments, which show that the weight may be tolerably correctly taken at 67 lbs. and the value of P at 900:—

Experiment by whom made.	Year.	Wood whence procured.	Number of experiments.	Size of bar.	Weight.	Value of P.
				ft. in. in.	lbs.	
Brandis	1864	Bengal	9	6 × 2 × 2	62	860
"	"	"	2	6 × 2 × 1½	63	927
"	1865-6	"	1	6 × 2 × 2	65	783
"	"	"	5	3 × 1 × 1	66	1288
Skinner, No. 79	1862	Burma	—	—	64	816
Campbell	"	Bengal (seasoned)	2	6 × 2 × 2	62·5	1038
"	"	" (unseasoned)	2	6 × 2 × 2	68	744
Baker	1829	" (5 years old)	4	7 × 2 × 2	64	984
"	"	" (4 years old)	1	6 × 2 × 2	62	859
"	"	" "	9	3 × 1½ × 1	—	848
"	"	" "	10	2 × 1 × 1	—	808
"	"	" "	6	7 × 2 × 2	68	883

Sundri wood is durable; it is heavy and does not float, and is extremely tough. It is used for a great variety of purposes, such as beams, buggy shafts, planking, posts, furniture, firewood; but chiefly in boat-building, for which purpose it is extensively used in Calcutta, and particularly in the Government Dockyard at Kidderpore. It is the chief timber of the Sundarbans forests. Its reproduction is most favourable. On all lands flooded by ordinary flood-tides, a new growth of jungle springs up immediately; but on lands ordinarily above high-water mark, it only establishes itself by slow degrees. It soon spreads itself on newly formed islands inside the sea edge of the forests. "The roots of the Sundri do not penetrate deep into the ground, but spread 'laterally 2 to 3 ft. below the surface, sending out perpendicular tough shoots, which 'stand from 3 to 15 in. in height all round the parent stem; and when there are 'many trees close together, walking through a Sundri forest is very much like finding 'one's way among a fine growth of inverted tent-pegs" (Home, in *Bengal Forest Report*, 1873–74, paragraph 13), which, as well as Dr. Schlich's article in the "Indian Forester," vol. i. p. 6, may be referred to for further details about Sundri. Sundri grows to a height of 50 to 60 ft., and has many buttresses.

The Sundri forests are generally very well stocked. Valuations made by Home in 1873–74 gave, for the average amount of material per acre of Sundri forest—

	No.
Seedlings and saplings under 3 ft. girth	2487
Trees above 3 ft. girth	182

The stock seems to have decreased, for in 1893, twenty years later, Heinig found only—

	No.
Under 3 ft. girth, over 9 in.	1103
Trees above 3 ft. girth	4

So that Working Plan Regulations clearly came none too soon. Heinig's calculations give 6·3 rings per inch radius, so that a 3-ft. tree would be about thirty-six years old.

		lbs.
E 401.	Sundarbans (Richardson)	70
E 2916.	"	66
B 3123.	Burma (Brandis, 1862)	69
E 3695.	Sundarbans (Gamble, 1882)	75

Nordlinger's Sections, vol. 11 (*H. littoralis*).

2. **H. littoralis**, Dryand.; Fl. Br. Ind. i. 363; Roxb. Fl. Ind. iii. 142; Bedd. Fl. Sylv. xxxiii.; Kurz For. Fl. i. 140; Talbot Bomb. List 22; Trimen Fl. Ceyl. i. 167. Vern. *Sundri*, Beng.; *Pinlèkanazo*, Burm.; *Mawtdá*, And.; *Chomuntiri*, Tam.; *Etuna*, Cingh.

A moderate-sized tree. *Bark* grey, longitudinally furrowed. *Wood* dark red, hard, similar and similar in structure to that of *H. minor*, except that it is lighter and more open in grain.

Coasts of India, Burma and Ceylon; Andaman and Cocos Islands; not in the Sundarbans (Prain), rare (Heinig). Wood used for similar purposes to that of *H. Fomes*, but in less demand.

The experiments made by Prof. W. C. Unwin, F.R.S., for the Imperial Institute, on Ceylon woods, gave the following results (*Imp. Inst. Journ.*, May, 1899):—

Weight	75·47 lbs. per cubic foot.
Resistance to shearing along the fibres	1333 lbs. per square inch.
Crushing stress	2·938 tons per square inch.
Coefficient of transverse strength	6·460 " "
Coefficient of elasticity	737·2 " "

		lbs.
B 517.	Andaman Islands (Gen. Barwell)	63
B 2285, 2226.	" (Col. Ford, 1866)	68 and 53

3. **H. acuminata,** Wall. *H. Papilio*, Bedd. Fl. Sylv. t. 218; Fl. Br. Ind. i. 363. Vern. *Akhar*, Cachar; *Soundalay únnu*, Tinnevelly.

A very lofty tree. *Wood* red, very hard, structure similar to that of *H. littoralis*, but *pores* less numerous and smaller, and transverse bars more numerous and more prominent, wavy, irregular.

Cachar and Lushai Hills in Eastern Bengal; evergreen forests of the Western Ghâts in Malabar, Travancore and Tinnevelly.

A handsome tree. The wood is used for building, cart poles and agricultural implements.

		lbs.
D 1066.	Tinnevelly (Beddome)	63
W 4299.	" (Brasier)	50

3. REEVESIA, Lindl. Two small trees. *R. Wallichii*, Br.; Fl. Br. Ind. i. 364, and *R. pubescens*, Mast.; Fl. Br. Ind. i. 364; Gamble Darj. List 11; Vern. *Kala boeri*, Nep., are trees of the Sikkim and Bhutan Himalaya and the Khasia Hills, up to 5000 ft.

4. KLEINHOVIA, Linn.

1. **K. Hospita,** Linn.; Fl. Br. Ind. i. 364; Roxb. Fl. Ind. iii. 141; Bedd. Fl. Sylv. xxxiii.; Talbot Bomb. List 22.

A tree. *Bark* brown, moderately thick. *Wood* soft, white. *Pores* large, scanty, single or in short strings of 2 to 3. *Medullary rays* moderately-broad to broad, not numerous.

Commonly cultivated in avenues and gardens in Calcutta and other places near the coast; probably indigenous in the Malay Peninsula and tropical Africa.

A handsome avenue tree with large leaves, pink flowers, and rather persistent membranous capsules.

		lbs.
E 4911.	Royal Bot. Garden, Calcutta (Prain)	28

5. HELICTERES, Linn.

The genus contains, besides the common *H. Isora*, Linn., six other species, chiefly small shrubs of Northern and Eastern Bengal and Burma, *H. elongata*, Wall.; Fl. Br. Ind. i. 365, and *H. spicata*, Colebr.; Fl. Br. Ind. i. 366, extending as far north as Sikkim.

1. **H. Isora,** Linn.; Fl. Br. Ind. i. 365; Roxb. Fl. Ind. iii. 143; Bedd. Fl. Sylv. xxxiii.; Brandis For. Fl. 34; Kurz For. Fl. i. 142; Talbot Bomb. List 23; Trimen Fl. Ceyl. i. 168. Vern. *Thur*, Jasrota; *Maror-phal, jonkaphal, kapasi, bhendu*, Hind.; *Itah*, Godavari; *Aita*, Gondi; *Kori-buta*, Kurku; *Anteri*, Banswara; *Gubadarra, kavanchi, guga tadda*, Tel.; *Kewani, maradsing*, Bombay; *Ainthia dhamin*, Monghyr;

Korajbothi, marorsheng, Berar; *Muri-muri, oola*, Uriya; *Renta, sakomsing*, Kól; *Aiteni*, Kharwar; *Petchumra*, Sonthal; *Mori*, Mal Pahari; *Kapeli*, Khond; *Kavargi*, Kan.; *Vallampuri*, Tam.; *Kolnaru*, Mal.; *Liniya*, Cingh.; *Thungè-che*, Burm.

A shrub. *Bark* grey. *Wood* white, moderately hard. *Pores* numerous, small, in short radial groups of 1 to 5, and somewhat concentrically disposed between the fine and very fine *medullary rays*. *Annual rings* marked by a pale line.

Sub-Himalayan tract from the Jhelum to Nepal; Behar; Central and South India; Kachin Hills of Burma; Ceylon in the low country.

A common undershrub of the forests, especially in second growth. It has leaves resembling those of the European hazel (*Corylus Avellana*). It is a useful plant in coppice woods, except that it may sometimes have a tendency to choke better species.

Growth moderate, 10 rings per inch of radius. The branches are used for fuel, fencing and thatching, and the bark yields a strong white fibre made into coarse cordage and canvas for gunny bags. The fruit is remarkable for its spirally twisted carpels; it is used in native medicine. The leaves are said not to be eaten by goats.

		lbs.
C 2804.	Melghát, Berar (Drysdale)	35
O 4801.	Budhaban Coppice, Saharanpur (Gradon)	47

6. PTEROSPERMUM, Schreb.

Twelve species, of which two are found in North-Western India, three in North-East India, seven in South India, five in Burma, and only one in Ceylon. They are all handsome plants, good for garden and park and avenue cultivation, especially *P. acerifolium*, which is a very beautiful tree, quickly and easily grown.

P. diversifolium, Bl.; Fl. Br. Ind. i. 367, is a tree of the South Carnatic in Tinnevelly. *P. aceroides*, Wall.; Kurz For. Fl. i. 145, is a handsome evergreen tree of Tenasserim and the Andaman Islands, resembling and often placed under *P. acerifolium*; but King (*Journ. As. Soc. Beng.* lx. 86), having long observed both in the Calcutta Botanic Garden, considers them as quite distinct. *P. reticulatum*, W. and A. and *P. obtusifolium*, Wight, are trees of the Western Ghát forests, but little known. *P. Blumeanum*, Korth.; King Journ. As. Soc. Beng. lx. 84 (*P. cinnamomeum*, Kurz and *P. javanicum*, Jungh.; Kurz For. Fl. i. 147) is a common tree in Martaban, with a red-brown, heavy, fibrous, close-grained wood.

Wood reddish, moderately hard. *Pores* small and moderate-sized, often in short radial lines. *Medullary rays* fine, closely packed.

1. P. acerifolium, Willd.; Fl. Br. Ind. i. 368; Roxb. Fl. Ind. iii. 158; Bedd. Fl. Sylv. xxxv.; Brandis For. Fl. 35; Kurz For. Fl. i. 145; Gamble Darj. List 11; Talbot Bomb. List 23. Vern. *Máyeng*, Jaunsar; *Kanakchampa, mús*, Beng.; *Hattipaila*, Nep.; *Numbong*, Lepcha; *Gaik*, Magh; *Machkunda*, Sonthal; *Makchand*, Mal Pahari; *Laider*, Mechi; *Taungpetwún*, Burm.

A tall tree. *Bark* thin, grey, smooth. Sapwood white; heartwood soft to moderately hard, red. *Pores* scanty, small, oval or elongated, generally subdivided, visible on a longitudinal section. *Medullary rays* fine, very numerous, undulating, not prominent, uniform and equidistant. Innumerable very fine concentric lines.

Sub-Himalayan tract from the Jumna eastwards; Bengal, Chittagong and Burma; Ghâts of N. Kanara; Andamans. Common in swamp forests in Dehra Dún near the Ganges. Often planted for ornament.

Weight: our specimens average 45 lbs. per cubic foot. Wood somewhat resembling *Thitka*, is worthy of notice; it is sometimes used for planking in Bengal. Leaves used as plates and for packing tobacco in Northern Bengal. The down on the leaves is used for tinder and to stop bleeding in wounds.

		lbs.
E 593.	Khookloong Forest, Darjeeling Terai (Manson)	44
E 3135.	Sukna Forest, Darjeeling Terai (Gamble)	48
E 3596.	Sivoke „ „ „	46
B 2510.	Burma (Brandis, 1862)	51

2. **P. suberifolium**, Lam.; Fl. Br. Ind. i. 367; Bedd. Fl. Sylv. xxxiv.; Talbot Bomb. List 23; Trimen Fl. Ceyl. 169. *P. canescens*, Roxb. Fl. Ind. iii. 162. Vern. *Baelo, bayalo, giringa*, Uriya; *Baili*, Khond; *Lolagu*, Tel.; *Muchucuda*, Mar.; *Tuddo, vinanku*, Tam.; *Welanga*, Cingh.

A moderate-sized tree. *Wood* light red, moderately hard. *Pores* small, scanty, often subdivided. *Medullary rays* closely packed, fine, the distance between them much less than the diameter of the pores. Occasional dark, narrow concentric lines, not continuous, but often breaking off suddenly.

Forests of Orissa, the N. Circars and Carnatic, common; forests of the Konkan and Kanara; dry region in low country of Ceylon.

A pretty tree, useful for fuel chiefly, but its tough wood is also used for building carts and other purposes. Growth rather fast: No. D 4101 gave only 3 rings per inch of radius.

The experiments made by Prof. W. C. Unwin, F.R.S., for the Imperial Institute, on Ceylon woods, gave the following results (*Imp. Inst. Journ.*, May, 1899):—

Weight	40·41 lbs. per cubic foot.
Resistance to shearing along the fibres	486 lbs. per square inch.
Crushing stress	1·934 tons per square inch.
Coefficient of transverse strength	4·247 „ „
Coefficient of elasticity	430·4 „ „

		lbs.
C 1250, 1311.	Gumsúr Forests, Ganjam (Dampier)	38 and 40
C 3523, 3534.	Khurdha Forests, Orissa (Gamble)	—
D 3930, 4101.	Striharikota Forest, Nellore (Gamble)	49 and 47

Ceylon Collection, No. 139, new (Mendis), doubtful.

Nordlinger's Sections, vol. 10 (medullary rays very short, arranged on the transverse section in a watermark pattern).

3. **P. rubiginosum**, Heyne; Fl. Br. Ind. i. 368; Bedd. Fl. Sylv. t. 106. Vern. *Kara-toveray, Chinna polavu*, Tam.; *Mala vúram*, Mal.; *Ponangka*, Trav. Hills.

A large handsome tree. *Wood* red, moderately hard, easily cut. *Pores* moderate-sized, scanty, resinous, evenly distributed. *Medullary rays* very fine, very numerous, brown. *Annual rings* fairly prominent.

Forests of the Western Ghâts, up to 3000 ft.

The Fl. Br. Ind. calls it a "shrub," although Beddome had described it as a "very large tree," and he, of course, knew it personally. Bourdillon says the wood is used in Travancore for building and boats, Beddome says the same for Tinnevelly. Bourdillon gives weight 40 lbs., which is nearly the average of our specimens.

		lbs.
W 4297.	Tinnevelly (Brasier)	34
W 4531.	Travancore (Bourdillon)	45

4. **P. semi-sagittatum**, Ham.; Fl. Br. Ind. i. 368; Roxb. Fl. Ind. iii. 160; Brandis For. Fl. 35; Kurz For. Fl. i. 146. Vern. *Nagyè*, Burm.; *Nwaleinbyeng*, Magh.

A moderate-sized tree with an irregularly shaped, fluted stem. *Bark* grey, 1 to 2 in. thick. *Wood* reddish-grey, moderately hard; structure the same as that of *P. acerifolium*, but with more numerous pores and a few broader *medullary rays*.

Chittagong and Burma, usually in dry forests like Eng-deing; sometimes planted in other parts of India.

The tree is distinguished by its very one-sided leaves, semi-sagittate at base, and laciniate stipules. Growth moderately fast, 6 rings per inch of radius. Weight 40 to 50 lbs. per cubic foot. Wood durable.

		lbs.
B 2511.	Burma (Brandis, 1862)	40
B 2706.	Tavoy (Wallich, 1828)	50

Similar in structure to this is B 1418, sent from Burma under the name of *Hman*, the chief difference between its wood and that of *P. semi-sagittatum* being that it is scented, smoother, and has much smaller pores.

5. P. lanceæfolium, Roxb. Fl. Ind. iii. 162; Fl. Br. Ind. i. 368; Brandis For. Fl. 35; Kurz For. Fl. i. 146. Vern. *Ban kalla*, Beng.

A large tree. *Wood* moderately hard, structure the same as that of *P. acerifolium*, the distance between the rays being less than the transverse diameter of the pores.

Sub-Himalayan tract from the Jumna (Ganges?) eastwards; Eastern Bengal down to Chittagong; ascending to 4000 ft.

I have never seen it between the Jumna and Ganges except in cultivation at Dehra Dún and Saharanpur.

		lbs.
O 3659.	Saharanpur Bot. Garden, N.-W.P. (Gollan)	—
O 4645.	Forest School Garden, Dehra Dún (Gamble)	46

6. P. Heyneanum, Wall.; Fl. Br. Ind. i. 369; Bedd. Fl. Sylv. xxxiv.; Talbot Bomb. List 23. Vern. *Polavu*, Tam.; *Mala-túram*, *thopali*, *palaka unam*, Mal.; *Nay unam*, Trav. Hills.

A tree. *Bark* brown, rough, ¼ in. thick. *Wood* light red, hard, annual rings marked by a wavy dark line without pores. Structure similar to that of *P. acerifolium*.

Forests of the South Deccan and drier parts of the hills southwards. It is common in Cuddapah, and Talbot says it is found in Dharwar.

A pretty tree, with leaves like those of *P. acerifolium*, but smaller and less rounded. Bourdillon gives weight 43 lbs., P = 603.

		lbs.
D 4225, 4226.	Cuddapah Forests (Gamble)	45
W 4581.	Travancore (Bourdillon)	43

7. P. glabrescens, W. and A.; Fl. Br. Ind. i. 369; Bedd. Fl. Sylv. xxxix.

A moderate-sized handsome tree. *Wood* reddish, soft. *Annual rings* prominent. *Pores* moderate-sized, scanty, often subdivided into 2 or 3. *Medullary rays* very numerous, fine. Growth fast.

Forests of the Western Gháts from S. Kanara to Tinnevelly.

		lbs.
W 4582.	Travancore (Bourdillon)	29

7. ERIOLÆNA, DC.

Six species. *E. quinquelocularis*, Wight; Fl. Br. Ind. i. 371; Bedd. Fl. Syl. xxxv.; Talbot Bomb. List 24, is a small tree of S. India very common on the slopes of the Nilgiris and in Wynaad, also in the Konkan and South-West Deccan.

Wood hard, reddish, close-grained, mottled. *Pores* moderate-sized, in rings of soft tissue often arranged in concentric bands. *Medullary rays* moderately broad, uniform.

1. E. **Wallichii**, DC; Fl. Br. Ind. i. 370; Gamble Darj. List 12. Vern. *Kubindé*, Nep.

A small tree. *Bark* ⅓ in. thick, brown. *Wood* hard, mottled: sapwood grey; heartwood reddish-brown. *Pores* moderate-sized, often subdivided, enclosed in irregular patches of soft tissue, and arranged in concentric lines. *Medullary rays* moderately broad and very fine.

Nepal and Sikkim Himalaya.
The wood is much esteemed by Nepalese.

		lbs.
E 2326.	Bamunpokri, Darjeeling (Gamble)	40

2. E. **Stocksii**, Hook. f. and Th.; Fl. Br. Ind. i. 370; Talbot Bomb. List 24.

A small tree. *Bark* grey, ¼ in. thick, cleft horizontally in narrow lines. *Wood* white or yellowish-white, with a small dark grey heartwood, hard, close-grained. *Pores* moderate-sized, often in groups of 2 or 3, or joined concentrically by short white lines. *Medullary rays* fine, numerous, white, prominent. *Annual rings* marked by a white line.

Forests of the Konkan and South Deccan.

		lbs.
D 3867.	Horsleykonda, Cuddapah, 3500 ft. (Gamble)	60

3. E. **Hookeriana**, W. and A.; Fl. Br. Ind. i. 370; Bedd. Fl. Sylv. xxxv.; Brandis For. Fl. 36; Talbot Bomb. List 24. Vern. *Arang*, Berar; *Kútki, bhonder*, Gondi; *Búndún, oit bulung*, Kól; *Poura*, Oraon; *Guagoli*, Sonthal; *Gua kasi*, Mal Pahari; *Nar botku*, Tel.

A small tree. *Bark* grey. *Wood* light red. *Annual rings* marked by an almost continuous line of pores. *Pores* small and moderate-sized, often subdivided, enclosed in rings of soft texture. *Medullary rays* moderate-sized, wavy.

Forests of the Central Provinces and adjacent regions; Western and Southern India, up to 4000 ft.
Beddome says the timber is tough and strong, prized for ploughs, etc.

C 3191. Chanda, C.P.
C 3437. Kumandi Reserve, Palamow (Gamble).

4. E. **Candollei**, Wall.; Fl. Br. Ind. i. 370; Kurz For. Fl. i. 148; Talbot Bomb. List 24. Vern. *Dwani*, Burm.; *Hadang*, Kan.

A deciduous tree. *Bark* grey. Heartwood brick-red, with orange and brown streaks, old pieces, however, losing their bright colour; hard, close-grained, shining, takes a beautiful polish, seasons well. *Pores* round, moderate-sized, arranged in concentric lines, and sometimes joined by narrow, wavy, concentric bands of soft tissue, prominent on a vertical section. *Medullary rays* numerous, white, prominent, fine and moderately broad. *Annual rings* marked by sharp concentric lines.

Burma, chiefly in the dry forests and in the Shan Hills at 3-5000 ft.; deciduous forests of N. Kanara and the Deccan.

A very fine wood. Weight, according to Kurz 47, according to Brandis' experiments 48 lbs.; the specimens average 51 lbs. According to Brandis' four experiments, made in 1864, with bars 3′ × 1″ × 1″, the value of P = 1020, which shows great transverse strength. Wood used for gunstocks, paddles and rice-pounders; it is very handsomely marked, and is well worthy of attention. In W. India it is used in cart-building.

			lbs.
B 286, 326.	Burma (1867)	. . . .	41 and 53
B 1455.	"	. . . .	54
B 2512.	" (Brandis, 1862)	. . . .	55

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5. **E. spectabilis,** Planch.; Fl. Br. Ind. i. 371.

A tree. *Wood* hard, light red, sapwood grey. *Pores* moderate-sized, subdivided, in narrow rings of white tissue and often joined by concentric lines. *Medullary rays* fine, numerous, white, prominent.

Sub-Himalayan tract of Oudh, Nepal, etc.

This is probably the tree referred to by Brandis (For. Fl. 36) as having been found by himself in Gorakhpur, Vern. *Beem*, and by R. Thompson in Oudh. Mr. Duthie's collectors have recently brought much of it from the Oudh Forests.

E 3707. Royal Bot. Garden, Calcutta (King, 1882).

8. MELHANIA, Forsk. About seven species, all undershrubs of little or no importance. *M. futteyporensis*, Munro; Fl. Br. Ind. i. 373, forms a considerable undergrowth in forests of *Anogeissus pendula* in Merwara (Duthie). They all belong to the dry regions of Sind, the Punjab and Deccan, except *M. Hamiltoniana*, Wall., which extends to Burma.

9. MELOCHIA, Linn.

1. **M. velutina,** Bedd. Fl. Sylv. xxxv.; Fl. Br. Ind. i. 374; Kurz For. Fl. i. 148. Vern. *Methuri*, Bombay.

A small tree. *Bark* grey, rough, with small horizontal fissures. *Wood* soft, sapwood light brown, heartwood light red. *Pores* large, subdivided radially into 2 or 3 or single. *Medullary rays* moderately broad, numerous, with a silver-grain of narrow horizontal plates.

Cultivated in Indian gardens, doubtfully indigenous.

Kurz speaks of this plant as "rather rare in the tropical forests of Burma," and as having a wood fit only for children's toys. Beddome refers to it as a garden shrub, introduced from Java.

Royal Bot. Garden, Calcutta, cyclone of 1865—Kew Museum.

10. ABROMA, Jacq.

1. **A. augusta,** Linn.; Fl. Br. Ind. i. 375; Roxb. Fl. Ind. iii. 156; Bedd. Fl. Sylv. xxxvi.; Gamble Darj. List 12. Vern. *Ullat kumal*, Beng.; *Sanu-kapashi*, Nep.

A large shrub. *Wood* light brown, soft. *Pores* moderate-sized, subdivided usually into 2 or 3 by partitions. *Medullary rays* very short, brown, fine and very fine, bent round the pores whose diameter is greater than the distance between them.

A forest underwood shrub in various parts, as in the Darjeeling Terai, probably introduced.

The bark gives a beautiful silky fibre, like that of hemp, and the shrub has often been recommended for growth as a crop, which would be very easy; but it would require rich land and plenty of moisture, and would not do for poor or dry soils.

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11. GUAZUMA, Plum.

1. **G. tomentosa,** Kunth; Fl. Br. Ind. i. 375; Bedd. Fl. Sylv. t. 107; Kurz For. Fl. i. 149; Talbot Bomb. List 24. Vern. *Rudraksha*, Tel.; *Thainpuchi*, Tam.

A small tree. *Bark* brown, rough. *Wood* white or yellowish-

white or light brown, soft, even-grained. *Annual rings* faintly marked. *Pores* moderate-sized, fairly numerous, often subdivided. *Medullary rays* moderately broad to broad, not numerous, conspicuous in the silver-grain on a radial section.

An American tree; introduced into India and common in warm regions, planted or run wild.

The tree is easily grown and is easily propagated. The wood is said by Beddome to be used for furniture, panels of coaches and packing-cases. He also says the leaves are an excellent fodder for cattle. Skinner, No. 77, gives W = 32' lbs., P = 596; Beddome gives W = 40 to 46 lbs.; specimen examined gives 38 lbs. The bark is said to be used to clarify sugar in the W. Indies (*Bomb. Agr. Dept. Report*, 1883–84).

		lbs.
E 4912.	Royal Bot. Garden, Calcutta (Prain)	38

12. BUETTNERIA, Linn. Four species, climbing shrubs. *B. crenulata*, Wall.; Fl. Br. Ind. i. 376 (*B. echinata*, Wall.; Kurz For. Fl. i. 151), is found in Nepal in the Central Himalaya and also in Burma. *B. aspera*, Colebr.; Fl. Br. Ind. i. 377; Kurz For. Fl. 151; Gamble Darj. List 12; Vern. *Nalgi*, Nep. is a climbing shrub of the Central and Eastern Himalaya up to 4000 ft., the Khasia Hills, the tropical forests of Burma and the Andamans. It forms often a very dense growth, and has large fruit with strong spikes. *B. andamanensis*, Kurz For. Fl. i. 152; Fl. Br. Ind. i. 377, is a climbing shrub of Tenasserim and the Andamans. *B. pilosa*, Roxb. Fl. Ind. i. 618; Fl. Br. Ind. i. 377; Kurz For. Fl. i. 151; Gamble Darj. List 12; Vern. *Sali*, Nep.; *Tattayanwè*, Burm., is a large climber of the Eastern Himalaya up to 4000 ft., and thence down to and throughout Burma. Such climbers are usually cut as being an impediment to tree-growth.

13. LEPTONYCHIA, Turcz. Two shrubs or small trees. *L. moacurroides*, Bedd. Fl. Sylv. t. 114; Fl. Br. Ind. i. 379 (*L. heteroclita*, Kurz For. Fl. i. 150), is a small pretty tree of the forests of the Western Coast in the Wynaad, Malabar, and down to Tinnevelly. *L. glabra*, Turcz.; Fl. Br. Ind. i. 379; Kurz For. Fl. i. 150 (*Grewia heteroclita*, Roxb. Fl. Ind. ii. 590) is an evergreen tree of Tenasserim.

ORDER XXI. TILIACEÆ.

Eleven Indian genera of woody plants, some of them of considerable importance for timber, some as affecting forest growth, and some as fibre-yielders. Species of *Corchorus*, *e.g.* *C. capsularis*, Linn.; Vern. *Pat*, Beng., the Jute plant; and *Triumfetta*, Linn., have useful fibres, and the former is very largely grown in India for export. In Europe the Order is represented by the Lime trees or Lindens, genus *Tilia*, Linn.

The Order is divided into 4 Tribes, viz.—

Tribe I. Brownlowieæ	Brownlowia, Pentace, Pityranthe, Berrya.
„ II. Grewieæ	Grewia, Columbia, Erinocarpus.
„ III. Tilieæ	Plagiopteron, Trichospermum.
„ IV. Heteropetalæ	Echinocarpus, Elæocarpus.

Wood of various colours, usually moderately hard, sometimes very hard. *Pores* numerous, uniformly distributed, small or moderate-sized. *Medullary rays* fine, equidistant.

1. BROWNLOWIA, Roxb.

Three species. *B. lanceolata*, Bth.; Fl. Br. Ind. i. 381; Kurz For. Fl. i. 154; Vern. *Kedar-sundri*, Beng., is a tree of the tidal swamps on the coast of the Bay of Bengal from the Sundarbans through Arracan to Pegu and Tenasserim. *B. peltata*, Bth.; Kurz For. Fl. i. 153, is a small tree of Tenasserim.

1. **B. elata,** Roxb.; Fl. Br. Ind. i. 381; Kurz For. Fl. i. 153. *Humea elata,* Roxb. Fl. Ind. ii. 640. Vern. *Masjot, mossé,* Beng.

A large evergreen tree. *Wood* soft, reddish-grey. *Pores* moderate-sized, usually subdivided, scanty. *Medullary rays* short, moderately broad, joined by innumerable extremely fine irregular transverse bars, which do not join into concentric rings.

Forests of the tidal waters on the coasts of the Sundarbans, Chittagong and Tenasserim, associated with "sundri."

Roxburgh says that it often reaches 15 ft. in girth. There is some slight doubt of the identity of this wood (see note in Ed. i. p. 51), but I believe that the present identification is correct.

		lbs.
E 1951.	Chittagong Forests (Chester)	42

2. PENTACE, Hassk.

Two species, both giving valuable timbers.

1. **P. burmanica,** Kurz: Fl. Br. Ind. i. 381; Kurz For. Fl. i. 154. Vern. *Thitka, kashit, kathitka,* Burm.

A very large, tall tree. *Wood* light red, shining, moderately hard, even-grained, takes a good polish. *Pores* moderate-sized, often oval and subdivided into compartments, fairly numerous, uniformly distributed. *Medullary rays* fine, wavy, red, visible on a radial section as a pretty silver-grain, equidistant; the distance between the rays generally equal to the transverse diameter of the pores. *Annual rings* fairly well marked by hard autumn wood.

Burma, in the tropical forests of Pyinmana, the Pegu Yoma, Martaban and Tenasserim.

Growth rapid, 3 to 4 rings per inch of radius. Weight 42 lbs. on an average. Now very largely used in Burma for boats, boxes and other purposes for which a light wood is required. Large quantities are annually exported, and though a few years ago the wood was quite unknown, it is now well known, even in European markets. It resembles the wood of some MELIACEÆ, like Mahogany or *Chikrassia.* It is sometimes cut up into thin planking and exported to Assam to make tea-boxes.

Romanis' experiments in analysis of the ashes of Burmese timbers gave the following results:—

	Sapwood.	Heartwood.
Potash	32·60	18·85
Soda	0·25	2·89
Lime	6·71	40·06
Magnesia	21·63	12·06
Oxide of manganese . . .	0·71	5·65
„ iron	5·45	9·45
Phosphoric acid	26·22	8·36
Sulphuric acid	1·71	2·67
Silicic acid	4·68	—

		lbs.
B 281.	Burma (1867)	42
B 802.	Tharrawaddi, Burma (Ribbentrop)	41
B 815.	Rangoon „ „	48
B 1386.	Moulmein „	41
B 3119.	Burma (Brandis, 1862)	42

2. **P. Griffithii**, King in Journ. As. Soc. Beng. lx. ii. 104. *P. decaptera*, King in Herb. and Mus. Dehra Dún. Vern. *Thitkalé*, Burm.

A large tree. *Wood* light red, hard, close-grained, resembling that of *P. burmanica*. *Pores* moderate-sized, sometimes subdivided, rather scanty, evenly distributed. *Medullary rays* fine, numerous, regular, giving a pretty silver-grain with a satiny lustre; the distance between the rays about equal to the diameter of the pores.

Forests of Tavoy; discovered by the late Mr. T. A. Aplin, Deputy Conservator of Forests, in moist forests and on low hills.

It has a much-buttressed stem. The wood is likely to be useful, better if anything than that of *P. burmanica*.

		lbs.
B 4075.	Tavoy (Palmer)	47

3. PITYRANTHE, Thw. *P. verrucosa*, Thw.; Fl. Br. Ind. i. 382; Bedd. Fl. Sylv. t. 109; Trimen Fl. Ceyl. i. 172; Vern. *Vidpani*, Tam.; *Dik-wenna*, Cingh., is a tree of Ceylon, common locally, as at Jaffna, Trincomali and Batticaloa. Trimen says, "wood tough, yellow, heavy, very strong and much sought after in the Eastern 'Province for axles of timber carts, etc., but it is small, not exceeding 2½ to 3 ft. in 'girth."

4. BERRYA, Roxb.

1. **B. Ammonilla**, Roxb. Fl. Ind. ii. 639; Fl. Br. Ind. i. 383; Bedd. Fl. Sylv. t. 58; Kurz For. Fl. i. 155; Trimen Fl. Ceyl. i. 173. The Trincomali wood. Vern. *Petwún*, Burm.; *Halmillila*, *halmilla*, Cingh. (whence the specific name); *Chavandalai*, Tam.

A large tree. *Bark* thin, smooth, pale. *Wood* dark red, very hard, close-grained, but apt to split; it has, even when old, a smooth, rather damp or oily feel and characteristic odour. *Pores* moderate-sized, oval, subdivided, enclosed in pale patches, which are united by very narrow undulating bands of soft tissue. *Medullary rays* moderately broad, prominent, numerous, uniform and equidistant; the distance between the rays equal to the transverse diameter of the pores.

Forests of the dry country of Ceylon; the Shan Hills, the drier upper mixed and hill Eng forests of Pyinmana, Ruby mines, Martaban and the Pegu Yoma in Burma, up to 3000 ft.; also Little Coco Island (Prain); said to be found in S. India, but wild trees have not been recorded. Often planted as a forest tree or for ornament.

This fine tree is one of the principal trees of Ceylon, and gives a fine timber.

The weight and transverse strength have been determined by the following experiments:—

Experiment by whom conducted.	Year.	Wood whence procured.	Number of experiments.	Size of scantling.	Weight.	Value of P.
				ft. in. in.		
Brandis . .	1864	Burma	7	3 × 1 × 1 2 × 1 × 1	64	825
" No 8 .	1862	"	—	—	56–62	—
Puckle . . .	—	Mysore	2	2 × 1 × 1	—	971
Skinner No. 28 .	1862	Ceylon	—	Various	50	784
" No. 31 .	"	"	—	—	63	1012
Cat. Exh., 1862 .	"	"	—	3 × 1½ × 1½	50	622–1028
Baker . . .	1829	"	3	6 × 2 × 2	51	700
A. Mendis, No. 33	—	"	—	2 × 1 × 1	48	844
Smythies . .	1878	Burma	6	—	61	—
Molesworth . .	—	—	—	—	50	844, E = 3000

The experiments made by Prof. W. C. Unwin, F.R.S., for the Imperial Institute, on Ceylon woods, gave the following results (*Imp. Inst. Journ.*, May, 1899):—

Weight	49·93 lbs. per cubic foot.
Resistance to shearing along the fibres	830·3 lbs. per square inch.
Crushing stress	3·442 tons per square inch.
Coefficient of transverse strength	6·898 " "
Coefficient of elasticity	780·7 " "

Benson's *Byttneria*, weighing 72 lbs., is probably this. The wood is very durable. No. B 2722 had been fifty years in Calcutta, and was perfectly sound and good on being cut into. It is used for carts, agricultural implements and spear-handles, and in Madras for masúla boats, and is much esteemed for toughness and flexibility.

		lbs.
B 288.	Burma (1867)	52
B 327.	" (1866)	61
B 1420.	Tharrawaddi, Burma	65
B 1452.	Prome, Burma	65
B 2722.	Tavoy (Wallich, 1828)	63
B 3118.	Burma (Brandis, 1862)	58
No. 33, Ceylon Collection, old, No. 45, new (Mendis)—poor specimen		48

5. GREWIA, Linn.

A large genus of plants of forest interest, containing about 34 species, of which about 12 only are trees or small trees, and the rest shrubs or climbers. *G. oppositifolia* is found up to 6000 ft. in the North-West Himalaya, and one or two shrubby or semi-scandent species rise to nearly that height in the hills of S. India and Burma. There are 7 species in Northern India, 8 in the North-East, 17 in Western India, 18 in South India, 14 in Burma, and 10 in Ceylon.

As described in Fl. Br. Ind. it contains 3 sections, of which the first, *Grewia*, contains the majority of species. The second, *Omphacarpus*, contains only one species, *G. calophylla*, Kurz For. Fl. i. 157; Vern. *Mayanbo*, Burm., a small evergreen tree of the coast forests of the Andamans. The third, *Microcos*, contains two species: *G. sinuata*, Wall.; Fl. Br. Ind. i. 392; Kurz For. Fl. i. 158, a large shrub of the swamp forests of Burma; and *G. Microcos*, Linn. In the section *Grewia*, besides those herein described, may be noticed: *G. villosa*, Willd.; Fl. Br. Ind. i. 388; Brandis For. Fl. 39; Vern. *Inzarra*, *pastuwanne*, Pb.; *Dhohan*, Ajmere; *Jalidar*, *kaskúsri*, *thamther*, Salt Range, a small shrub of the arid zone in Rajputana, the Punjab and Sind; *G. sapida*, Roxb. Fl. Ind. ii. 590; Fl. Br. Ind. i. 387; Brandis For. Fl. 41; Gamble Darj. List 12; Vern. *Bistu*, Jaunsar, a well-known, small, yellow-flowered undershrub of the Sub-Himalayan forests, sending up yearly numerous shoots from a perennial rootstock; and *G. sclerophylla*, Roxb.; Brandis For. Fl. 39; Kurz For. Fl. i. 162 (*G. scabrophylla*, Roxb. Fl. Ind. ii. 584; Fl. Br. Ind. i. 387; Gamble Darj. List 12); Vern. *Garbhali*, Dehra Dún; *Pharsia*, Kumaon, a small shrub with white flowers and large leaves, of similar localities; while *G. abutilifolia*, Juss.; Fl. Br. Ind. i. 330; Beddome Fl. Sylv. xxxvii. (*G. aspera*, Roxb. Fl. Ind. ii. 591); Vern. *Pedda taraki*, Tel., is a small tree found in Southern India. *G. elatostemoides*, Coll. and Hemsl.; Journ. Linn. Soc. xxviii. 27, is a small tree of the Shan Hills at 3000 feet. Some species of *Grewia* have edible fruits, and the wood of some is strong, tough and elastic.

The *wood* of *Grewia* has small or moderate-sized *pores*, uniformly distributed, and numerous fine, rarely moderately broad *medullary rays*. The *annual rings* are generally marked. *G. Microcos* has a rather different structure, with concentric bands and very short medullary rays.

The genus is badly in need of careful revision, and I do not feel quite certain about the identification of some of the wood-specimens.

1. **G. oppositifolia,** Roxb. Fl. Ind. ii. 583; Fl. Br. Ind. i. 384; Brandis For. Fl. 537. Vern. *Dhamman, pharwa,* Pb.; *Biúl, biúng, bahúl, bhimal, bewal, behel, bhengal,* Hind.; *Bieul,* Simla; *Bhiúnl,* Kumaon; *Pastuwanne,* Afg.

A moderate-sized tree. *Bark* grey, smooth. *Wood* white, with a small mass of irregularly-shaped heartwood, hard, giving out an exceedingly unpleasant odour, especially when fresh cut. *Annual rings* marked by white lines. *Pores* moderate-sized, very numerous, uniformly distributed. *Medullary rays* fine, white, wavy, very numerous.

North-West Himalaya, from the Indus to Nepal, ascending to 6000 ft.

Growth moderate, 7 rings per inch of radius. Weight 45 to 50 lbs. per cubic foot. The wood is used for oar-shafts, handles, bows, etc., and for most purposes for which elasticity and toughness are required. The bark gives a fibre which is much used in the North-West Himalaya for rope and paper-making, but is not durable. The tree is much lopped for feeding cattle during the winter.

		lbs.
H 100.	Bhajji, Simla, 4000 ft.	45
H 154.	Sainj, „ 3000 „	50

2. **G. populifolia,** Vahl; Fl. Br. Ind. i. 385; Brandis For. Fl. 38; Talbot Bomb. List 26. Vern. *Ganger,* Pb.; *Gango,* Sind; *Gangerun,* Rajputana.

A small shrub, with grey *bark.* *Wood* yellow, hard, close-grained. *Annual rings* marked by an almost continuous line of slightly larger pores. *Pores* small, numerous, uniformly distributed. *Medullary rays* very fine, white, wavy, very numerous.

Arid country, in the Punjab, Sind, Rajputana and the Deccan.

Growth very slow. The wood is used for walking-sticks, and the fruit is eaten.

P 3228. Nagpahar, Ajmere.

3. **G. salvifolia,** Heyne; Fl. Br. Ind. i. 386; Bedd. Fl. Sylv. xxxvii.; Brandis For. Fl. 43; Talbot Bomb. List 26. Vern. *Bather, nikki-bekkar, gargas,* Pb.; *Saras,* Ajmere; *Heriss, seriss, sarisa, katang,* Merwara; *Heriss,* Jeypore; *Jára,* Circars; *Sitanga,* Sonthal; *Bursu, sita-pelu,* Kôl; *Kokorendua,* Mal Pahari.

A small tree. *Bark* dark-coloured, very rough. *Wood* yellow, heartwood orange-brown, hard, close-grained, structure similar to that of *G. tiliæfolia,* but *medullary rays* more numerous and *pores* smaller. *Annual rings* well marked by a line of larger pores.

Punjab, Sind, Central Provinces and Southern India.

Growth slow. Fruit small, edible.

P 3227. Nagpahar, Ajmere.
P 3237. Goran Hills, Ajmere.
C 3457. Barasand Reserve, Palamow (Gamble).

4. **G. orbiculata,** Rottl.; Fl. Br. Ind. i. 386; Talbot Bomb. List 26.

A small tree. *Bark* very rough, brown, ½ in. thick. *Wood* yellow, hard, close-grained. *Pores* small, rather scanty. *Medullary rays* fine, short, numerous.

Deccan, N. Circars and Konkan.

D 4165. Kottúr, Kistna (Gamble).

5. **G. tiliæfolia,** Vahl.; Fl. Br. Ind. i. 386; Roxb. Fl. Ind. ii. 587; Bedd. Fl. Sylv. t. 108; Brandis For. Fl. 41; Kurz For. Fl. i. 161; Talbot Bomb. List 26; Trimen Fl. Ceyl. 175. Vern. *Pharsa, phalsa, dhamin,* Hind.; *Pharsia,* Kumaon; *Pharsai,* Garhwal; *Khesla, kasúl,* Gondi; *Dhamni,* Kurku; *Olat,* Sonthal; *Kahei mohru,* Khond; *Tara,* Palkonda; *Unu,* Tam.; *Charachi, jana, tharrá,* Tel.; *Dhamone,*

Uriya; *Thadsal, batala, tadasala*, Kan.; *Damnak*, Bhil; *Daman*, Mar.; *Sadachu chadache*, Mal.; *Daminiya*, Cingh.

A moderate-sized tree. *Bark* ⅓ in. thick, grey on young trees dark brown on old trees. Sapwood white; heartwood small, brown close-grained, hard. *Annual rings* marked by a line and the harder autumn wood. *Pores* moderate-sized, numerous, uniformly distributed *Medullary rays* fine, prominent on a radial section, giving a handsome silver-grain; the distance between the rays equal to the transverse diameter of the pores.

Sub-Himalayan tract from the Jumna to Nepal, ascending to 4000 ft.; Central and South India; Upper Burma; low country of Ceylon.

A very widespread tree of the deciduous forests, often with Sál or Teak; quick growing, and comes up fast in blanks in the forest. Growth moderate, about 6 rings per inch of radius. Weight, according to Skinner No. 75, 34 lbs.; Brandis says 30 to 40 lbs.; the average of those examined gave 48 lbs. Skinner's experiments in South India gave P = 565. Talbot's experiments in Bombay in 1885 with pieces 6′ × 2′ × 2″ gave weight 50 lbs., P = 650; O'Connell, in Madras in 1886, found weight 4[illegible] lbs., a = 0·01096; Bourdillon in Travancore found weight 46 lbs., P = 603. Used for shafts, shoulder poles, masts, golf clubs, tool-handles, oars and all purposes for which elasticity, strength and toughness are required.

The fruit is eaten and the inner bark made into cordage. Fine specimens of this were sent from Berar for the Paris Exhibition of 1878.

		lbs.
O 5068.	Dehra Dún, 2000 ft. (U. N. Kanjilal)	42
C 188.	Mandla, Central Provinces (1871)	48
C 1169.	Ahiri Reserve, C.P. (R. Thompson)	46
C 2757.	Moharli Reserve, C.P. (Brandis)	53
C 2766.	Melghát, Berar (Brandis)	—
C 1253.	Gumsúr, Ganjam (Dampier)	49
C 3818.	Surada Forests, Ganjam (Gamble)	58
No. 17,	Ceylon Collection, old and new (Mendis)	44

6. G. vestita, Wall.; Brandis For. Fl. 40; Gamble Darj. List 12. *G. elastica* Kurz For. Fl. i. 160, not, I think, of Royle. *G. asiatica*, Linn. var.; Fl. Br. Ind. i 387. Vern. *Farri, phalwa, dhamman*, Pb.; *Pharsia, dhamún, bimla*, Hind.; *Pharsuli*, Kumaon; *Pharsawon, pharsanyi*, Garhwal; *Pharson*, Dotial; *Poto dhamun* Palamow; *Sealposra*, Nep.; *Kúnsúng*, Lepcha; *Pershuajelah*, Mechi; *Dhamin, háse dhamin*, Merwara; *Pintayaw*, Burm.

A tree. *Bark* grey, with numerous small horizontal clefts. *Wood* greyish-white, hard and close-grained. *Annual rings* prominent marked by hard autumn wood. *Pores* moderate-sized or small, scanty *Medullary rays* fine and moderately broad, numerous, prominently marked on a radial section, and giving the wood a fine silver-grain.

Sub-Himalayan tract from the Indus eastwards, Bengal, Central India and Burma where it extends north to the Kachin Hills.

A largish tree, common in Sál and similar forests. Growth moderately slow, 5 to 7 rings per inch of radius. Weight: the specimens give an average of 48 lbs. per cubic foot; Brandis says 50 lbs. Wood tough and elastic, used for shoulder poles, bows, spear-handles, etc.; splits well, and is sometimes used for shingles. The branches are lopped for fodder. The true *G. elastica*, Royle Ill. t. 22, is a small tree found in valleys in the North-West Himalaya at 3–4000 ft., with reddish-white, very pubescent foliage and flowers without glands or gynophore. In my opinion, it is a well-marked species quite distinct from *G. asiatica* or *G. vestita*.

		lbs.
O 5066.	Dehra Dún, 2000 ft. (U. N. Kanjilal)	37
E 651.	Bamunpokri, Darjeeling Terai (Manson)	43
E 2325.	" " " (Gamble)	51
B 3120.	Burma (Brandis, 1862)	51

7. G. asiatica, Linn.; Fl. Br. Ind. i. 386; Roxb. Fl. Ind. ii. 586; Bedd. Fl. Sylv. xxxvii.; Brandis For. Fl. 40; Kurz For. Fl. i. 161; Talbot Bomb. List 26; Trimen Fl. Ceyl. i. 174. Vern. *Phalsa*, Hind.; *Dhamni*, Ajmere; *Atia dhamin*, Merwara.

A small tree. *Bark* grey, rough, ¼ to ½ in. thick. *Wood* hard, pinkish or yellowish grey, sapwood white. *Pores* moderate-sized, sometimes subdivided, scanty, unevenly distributed. *Medullary rays* numerous, moderately broad, causing a marked silver-grain on a radial section.

Wild in Central and South India, extending to Rajputana and the Siwaliks; elsewhere cultivated.

The tree is cultivated in India and Ceylon for its edible fruit. The bark gives a fibre. It is, or was, also used in Saharanpur to clarify sugar.

		lbs.
O 4834, 5067.	Dehra Dún, N.-W. Provinces (U. N. Kanjilal)	47 and 39
P 470.	Ajmere	—
P 3218.	Nagpahar, Ajmere	—
P 3235.	Goran Hills, Ajmere	—
W 4144.	Palghat, Malabar (dark-brown wood) (Morgan)	—

8. G. pilosa, Lam.; Fl. Br. Ind. i. 388; Brandis For. Fl. 39; Talbot Bomb. List 26; *G. carpinifolia*, Roxb. Fl. Ind. ii. 587. Vern. *Posangni*, Ajmere; *Pisangan, parangan, phiongli*, Merwara; *Bhorkund*, Monghyr; *Gursikri*, Kharwar; *Sitarga*, Sonthal; *Ghordhaman*, Berar.

A shrub with four-angled stem and brown *bark*. *Wood* yellowish-white, hard, divided into triangular wedges proceeding from the centre towards the four corners and sides, the *annual rings* in the wedges towards the corners marked by large pores, those towards the sides by a white line and a few moderately large pores. *Pores* in the rest of the wood small. *Medullary rays* fine, white, numerous.

Plains of North-West, Central and South India, in dry regions.

P 3230. Nagpahar, Ajmere.
P 3256. Goran Hills, Ajmere.

9. G. multiflora, Juss.; Fl. Br. Ind. i. 388; Gamble Darj. List 12. *G. sepiaria*, Roxb. Fl. Ind. ii. 589; Brandis For. Fl. 42. Vern. *Pansaura*, Hind., Beng.; *Nilay*, Nep.

A shrub or small tree. *Bark* brown. *Wood* white, soft, similar in structure to that of *G. oppositifolia*, but with smaller pores.

Outer Himalaya from Nepal eastwards, ascending to 4000 ft.; Khasia Hills. Used in Bengal for making hedges, for which it is very useful.

		lbs.
E 2327.	Sivoke, Darjeeling Terai (Gamble)	42

10. G. lævigata, Vahl; Fl. Br. Ind. i. 389; Bedd. Fl. Sylv. xxxvii.; Brandis For. Fl. 42; Kurz For. Fl. i. 150; Gamble Darj. List 12; Talbot Bomb. List 26. *G. didyma*, Roxb. Fl. Ind. ii. 591. Vern. *Kat bhewal, bhimúl, kakki*, Hind.; *Dali bhimal*, Kumaon; *Allpeyar*, Tel.; *Dansagla*, Lepcha; *Bolmengo*, Gáro; *Kokúrsida*, Mechi; *Tayaw*, Burm.

A small tree. *Bark* dark-grey, thin, with vertical reticulations. *Wood* white, soft to moderately hard, even-grained. *Annual rings* marked by a dark line with few pores. *Pores* moderate-sized, usually subdivided, scanty. *Medullary rays* few, fine to moderately broad.

Outer Himalaya, from the Jumna eastwards; Assam; Central and Southern India and Burma; more scarce in W. India.

In Northern India and in places in the centre and south, in ravines and near villages, this is a common plant, easily recognized by its long glabrescent leaves.

		lbs.
O 4835.	Dehra Dún, N.-W. Provinces (U. N. Kanjilal) . . .	36

11. G. Microcos, Linn.; Fl. Br. Ind. i. 392; Kurz For. Fl. i. 157; Talbot Bomb. List 26; Trimen Fl. Ceyl. i. 177. *G. ulmifolia*, Roxb. Fl. Ind. ii. 591. Vern. *Aswar*, Beng.; *Shirúl, asolin*, Mar.; *Taráh*, Magh; *Thayoh*, Arr.; *Myatya*, Burm.; *Kéliya, kohu-kirilla*, Cingh.

A small tree. *Wood* grey, soft. *Pores* moderate-sized, scanty, joined by wavy belts of soft tissue, broken but concentrically arranged. *Medullary rays* short or very short, moderately broad, the distance between them about equal to the diameter of the pores.

Eastern Bengal, Chittagong, Burma, S. India and Ceylon, very common in Burma. Weight 51 lbs. per cubic foot (Brandis No. 10).

Nordlinger's Sections, vol. 4.

6. COLUMBIA, Pers. Two small Burmese trees or shrubs. *C. floribunda*, Wall.; Fl. Br. Ind. i. 392; Kurz For. Fl. i. 156, is a shrub of the Martaban Hills and the Shan Hills in Upper Burma. *C. merguensis*, Planch. is found in Mergui.

7. ERINOCARPUS, Nimmo.

1. E. Nimmoanus, Grah.; Fl. Br. Ind. i. 394. *E. Nimmonii*, Grah.; Bedd. Fl. Sylv. t. 110; Talbot Bomb. List 27. Vern. *Chor, choura, chira, haladi*, Mar.; *Adivi bhendi, kád bende*, Kan.

A tree. *Bark* brown, smooth, with narrow longitudinal clefts, fibrous, ⅜ in. thick. *Wood* white, soft. *Annual rings* distinct, marked by more numerous pores in the early spring wood. Many fine, close, wavy, concentric, white lines. *Pores* few, large, single or subdivided, scattered irregularly. *Medullary rays* fine to moderately broad, long, rather scanty.

Deciduous forests of the Konkan and Kanara, and adjacent Gháts.
The bark gives a rope fibre. Growth fast, 3 rings per inch.

		lbs.
W 4304.	S. Kanara (Peake)	29

8. PLAGIOPTERON, Griff. *P. fragrans*, Griff.; Fl. Br. Ind. i. 399, is a climbing shrub of Mergui.

9. TRICHOSPERMUM, Bl. *T. Kurzii*, King Journ. As. Soc. Beng. lx. ii. 119, is a tree 40 to 60 ft. high, found by Kurz in the Nicobar Islands.

10. ECHINOCARPUS, Blume.

Contains five large trees of the forests of the north-east and east moist zone in Sikkim, Bhutan, Assam, the Khasia Hills and Burma. *E. sterculiaceus*, Bth.; Fl. Br. Ind. i. 400; Gamble Darj. List 12; Vern. *Banj*, Nep.; *Saimuladdi*, Mechi; *Thabola*, Magh, is a very large tree of the Sikkim Terai, Chittagong and Burma, with a deeply buttressed trunk and large fruit covered with long needle-like spines. *E. tomentosus*, Bth.; Fl. Br. Ind. i. 400; Gamble Darj. List 12; Vern. *Kaktay*, Nep.; *Taksor*, Lepcha, is a large tree of the Sikkim Hills from 2–4000 ft. *E. Murex*, Bth.; Fl. Br. Ind. i. 399, is a large tree of the Khasia Hills and Burma (*E. Sigun*, Bl.; Kurz For. Fl. i. 162); and *E. assamicus*, Bth.; Fl. Br. Ind. i. 399; Vern. *Jabba hingori*, Ass., a tree of Upper Assam, whose wood, according to Mann, is used for planking.

1. **E. dasycarpus,** Bth.; Fl. Br. Ind. i. 400; Gamble Darj. List 12. Vern. *Gobria,* Nep.; *Taksol,* Lepcha.

A large tree. *Bark* dark grey. *Wood* greyish-brown, soft. *Pores* small, regular. *Medullary rays* fine and moderately broad, closely packed, straight, prominent on a radial section.

Eastern Himalaya, 5–7000 ft. Hooker, in Fl. Br. Ind., says, "Sikkim at 2000 'feet," but I have never seen it below 5000 ft.

An important hill tree, as the wood is used for planking, for tea-boxes and to make charcoal. It is in considerable demand in Darjeeling. The tree is very handsome, as it has showy clusters of yellow-white flowers, capsular fruit with short close-set spines, black seeds with a red arillus, and drooping branches. It flowers and seeds freely each year, and seedlings come up well.

		lbs.
E 694.	Chuttockpur, Darjeeling, 6000 ft. (Manson)	32
E 3610.	Darjeeling, 7000 ft. (Gamble)	—
	Nordlinger's Sections, vol. 10.	

E 1289, sent from Cachar under the name "*Sitarjat,*" has a similar structure, but the pores are larger. This is probably *E. tiliaceus* of G. Mann's Assam Lists (*Phul hingori,* Ass.; *Sitarsaaz,* Cachar), Assam Forest Reports, 1874–75 and 1875–76, perhaps *E. assamicus,* Bth., which is said by Mann to be used for planks and beams where not exposed to changes of weather.

11. ELÆOCARPUS, Linn.

A large genus of about 36 species, handsome trees with white flowers and fringed petals and with drupaceous fruit resembling an olive. The botanical arrangement of the genus requires some revision, like *Grewia* and other genera of this Order, and Sir D. Brandis has most kindly given me an abstract of his work on the subject. As it has not yet been published, however, I think it best to adhere still to the arrangement of the Fl. Br. Ind., with such modifications as have been published since. Brandis' work would not have made much change except in the arrangement of subgenera, of which there are three. *E. Braceanus,* Watt, is a tree of Manipur and Myitkyina, of whose position I am doubtful.

Wood greyish-white, soft. *Pores* small or moderate-sized, rather scanty, single, subdivided or in short radial lines. *Medullary rays* numerous, fine, not prominent.

Subgenus I. GANITRUS.

Two species. *E. stipularis,* Blume; Fl. Br. Ind. i. 404; Kurz For. Fl. i. 170, is a large evergreen tree of the tropical forests of Martaban and Tenasserim, up to 3000 ft., which Sir G. King places in this subgenus.

1. **E. Ganitrus,** Roxb. Fl. Ind. ii. 592; Fl. Br. Ind. i. 400; Bedd. Fl. Sylv. xxxvii.; Brandis For. Fl. 43; Kurz For. Fl. i. 168; Talbot Bomb. List 27. Vern. *Rudrak, rudraksh,* Hind.; *Rudai,* Ass.

A large tree. *Bark* dark grey, nearly smooth, rough only with small vertical lenticels and very narrow horizontal furrows. *Wood* greyish-white, soft. *Pores* small, scanty, often subdivided or in short radial lines. *Medullary rays* fine, numerous, inconspicuous.

Various parts of India. "Nepal, Assam, Western Gháts and probably also the 'Southern forests of the C.P." (Brandis); "Chittagong" (Kurz); "Kanara Gháts and 'Bombay Presidency" (Beddome); "Konkan Gháts" (Talbot).

A large tree whose hard tubercled nuts are polished, made into rosaries and bracelets, worn by Brahmins and Sanyásis, and sold in quantity at such places as

Benares, Allahabad and Hardwar. S. E. Peal says, "The wood of *Rudai* is par-'ticularly even and white, one of the whitest I know, with straight and fine grain, 'strong and tough. The tree is generally tall and branches above, having a straight 'stem 30 to 40 ft. in the bole, and 5 ft. in girth. It has a thin dark bark, long 'narrow leaves and small flowers" (*Ind. Tea Gaz.*).

		lbs.
E 4878.	Sylhet (Babu Kripa Nath De)	28

SUBGENUS II. DICERA.

Sixteen species. *E. floribundus*, Bl.; Fl. Br. Ind. i. 401; Kurz For. Fl. i. 167, is an evergreen tree found along streams in the tropical forests of Martaban, up to 3000 ft., and in the Nicobar Islands. *E. cuneatus*, Wight; Fl. Br. Ind. i. 402; Bedd. Fl. Sylv. xxxviii. (*E. lacunosus*, Wall.; Kurz For. Fl. 168); Vern. *Budalet*, Burm., is a tree of the Eastern Himalaya, Eastern Bengal, Burma and the Western Ghâts of S. India. *E. Helferi*, Kurz; Fl. Br. Ind. i. 402, and *E. leptostachya*, Wall.; Fl. Br. Ind. i. 403, are trees of Tenasserim. *E. hygrophilus*, Kurz For. Fl. i. 168, is an evergreen tree of the swamp forests of Burma, and *E. Wallichii*, Kurz For. Fl. i. 169, a tree of the Eng forests. *E. lucidus*, Roxb. Fl. Ind. ii. 600; Fl. Br. Ind. i. 403; Vern. *Bamau*, *wasopan*, Burm., is a tree of Chittagong. *E. sikkimensis*, Mast.; Fl. Br. Ind. i. 402; Gamble Darj. List 13, is a large tree of the Sikkim Himalaya, common below Darjeeling at 5000 ft. *E. oblongus*, Gaertn.; Fl. Br. Ind. i. 403; Bedd. Fl. Sylv. xxxviii.; Talbot Bomb. List 27; Vern. *Bikki*, Badaga; *Khas*, Mar., is a fine tree of the hills of the Western Ghâts, very common in the "shola" forests of the Nilgiris, and often conspicuous by its leaves turning red. Beddome says it has a strong white tough wood. *E. amœnus*, Thw.; Fl. Br. Ind. i. 404; Bedd. Fl. Sylv. t. 111; Trimen Fl. Ceyl. i. 185; Vern. *Titta-weralu*, Cingh., is a tree of the moist country of Ceylon up to 5000 ft. There are also three other species in Ceylon, two rare trees and *E. subvillosus*, Arn.; Fl. Br. Ind. i. 404; Trimen Fl. Ceyl. i. 186; Vern. *Gal-weralu*, Cingh., common in the low country.

2. E. serratus, Linn.; Fl. Br. Ind. i. 401; Brandis in For. Fl. 43; Bedd. Fl. Sylv. xxxviii.; Gamble Darj. List 13; Talbot Bomb. List 27; Trimen Fl. Ceyl. i. 184. Vern. *Jalpai*, Beng.; *Ulang kárai*, *uttracchum*, Tam.; *Valiya kara*, Mal.; *Weralu*, Cingh.

A rather small tree. *Wood* greyish-white. *Annual rings* prominent, marked by darker wood. *Pores* large, often subdivided, scanty, prominent on a radial section. *Medullary rays* very numerous, fine to moderately broad.

North-East Himalaya up to 3000 ft.; Eastern Bengal; evergreen forests of North Kanara and Western Coast down to Travancore, low country of Ceylon.

The fruit is known as "wild olives" and eaten. The wood is not of much use; Bourdillon gives weight 33 lbs. and P = 508.

		lbs.
W 4612.	Travancore (Bourdillon)	30

3. E. robustus, Bl.; Fl. Br. Ind. i. 402; Roxb. Fl. Ind. ii. 597; Kurz For. Fl. i. 169; Gamble Darj. List 13. Vern. *Jalpai*, Sylhet; *Bepari*, *batrachi*, Nep.; *Chekio*, Magh; *Tawmagyi*, Burm.

An evergreen tree. *Wood* white, shining, soft, even-grained. *Annual rings* marked by a prominent line. *Pores* moderate-sized, uniformly distributed, generally oval or elongated, subdivided. *Medullary rays* fine and very fine, closely packed, visible as long narrow bands in the silver-grain.

Eastern Himalaya, ascending to 2000 ft.; Khasia Hills, Eastern Bengal, Chittagong, Burma and Andaman Islands.

		lbs.
E. 581.	Khookloong Forest, Darjeeling Terai (Manson)	38

4. E. lanceæfolius, Roxb. Fl. Ind. ii. 598; Fl. Br. Ind. i. 402; Kurz For. Fl. i. 167; Gamble Darj. List 13. Vern. *Bhadras, batrachi,* Nep.; *Shepkyew,* Lepcha; *Sakalang,* Ass.

A large tree. *Wood* soft, light brown. *Pores* small, in short strings of 2 to 5. *Medullary rays* extremely numerous, fine and very fine, appearing as narrow plates in the silver-grain.

Eastern Himalaya from 6–8000 ft., Khasia Hills, Sylhet and Tenasserim.

Growth moderate, 8 rings per inch of radius. The wood is used for house-building, tea-boxes and charcoal. Fruit edible.

	lbs.
E 358. Rangbúl, Darjeeling, 7000 ft. (Johnston)	41
Nordlinger's Sections, vol. 10 (Tab. 1. 6).	

SUBGENUS III. MONOCERA.

Seventeen species. *E. tuberculatus,* Roxb. Fl. Ind. ii. 594; Fl. Br. Ind. i. 404; Bedd. Fl. Sylv. t. 113; Talbot Bomb. List 27; Vern. *Rudrak,* Hind.? *Dañala,* Mysore; *Pahumbon,* Kader; *Navádi, pulanthi,* Trav. Hills, is a very large tree of the Western Ghâts from Belgaum through Coorg, Wynaad, the Western Nilgiri slopes, the Anamalais, to Travancore. Its seeds are used for beads like those of *E. Ganitrus. E. rugosus,* Roxb. Fl. Ind. ii. 596; Fl. Br. Ind. i. 405; Kurz For. Fl. i. 166; Gamble Darj. List 13; Vern. *Nandiki,* Nep., is a large tree of the Darjeeling Terai, Chittagong and the tropical forests of Burma. *E. ferrugineus,* Wight; Fl. Br. Ind. i. 406; Bedd. Fl. Sylv. t. 112, is a common tree of the Nilgiri, Anamalai and Pulney Hills at 6–7000 ft., remarkable for having its leaves always folded back on either side of the midrib into the shape of a boat. *E. bracteatus,* Kurz For. Fl. i. 165; Vern. *Thitpwè,* Burm., is a large evergreen tree of the Shan Hills and of those of Martaban. *E. aristatus,* Roxb. Fl. Ind. ii. 599; Fl. Br. Ind. i. 405; Talbot Bomb. List 27, is a tree of various scattered habitats, as it is given from Bhutan, Sylhet, Assam, the Konkan and N. Kanara. *E. obtusus,* Blume (*E. Monocera,* Cav.; Fl. Br. Ind. i. 405, *E. venustus,* Bedd. Fl. Sylv. t. 174, *E. littoralis,* Kurz For. Fl. i. 167), is a tree of Assam and Burma. *E. acuminatus,* Wall., is a tree of Assam, Khasia Hills and Eastern Bengal; and *E. prunifolius,* Wall., is found in much the same region. *E. Griffithii,* Mast.; Fl. Br. Ind. i. 408; Vern. *Makauksan,* Burm., and *E. integer,* Wall.; Fl. Br. Ind. i. 408 (*E. petiolatus,* Kurz For. Fl. i. 164) are found in Tenasserim, while there are also three other species in Burma described by Kurz, viz. *E. simplex,* Kurz, *E. grandifolius,* Kurz, and *E. grandiflorus,* Sm. Two species occur in Ceylon, *E. glandulifer,* Mast.; Fl. Br. Ind. i. 187, being a large graceful tree common in the montane zone, at 3–6000 ft.

5. E. Munroii, Mast.; Fl. Br. Ind. i. 407; Talbot Bomb. List 27. *E. glandulifera,* Hook.; Bedd. Fl. Sylv. xxxviii.; Trimen Fl. Ceyl. i. 187. Vern. *Narébikki, kal bikki,* Badaga.

A large tree. *Wood* white, moderately hard. *Pores* moderate-sized, scanty. *Medullary rays* fine, very numerous.

Hills of South India and Ceylon, from 2500–6000 ft., not uncommon in the Nilgiris about Coonoor, and very pretty when in flower in the "sholas."

W 3776. Coonoor, Nilgiris, 6000 ft. (Gamble).

6. E. Varunua, Ham.; Fl. Br. Ind. i. 407; Gamble Darj. List 13; Kurz For. Fl. i. 165. Vern. *Tutticaly, saulkuri,* Ass.

A tree. *Bark* dark grey, smooth, but with prominent small lenticels, inner bark fibrous. *Wood* greyish-white, soft. *Pores* small, scanty, often subdivided or in short radial lines. *Medullary rays* numerous, fine.

Central and Eastern Himalaya from Kumaon to Assam, up to 2000 ft.; Eastern Bengal to Chittagong.

	lbs.
E 4887. Assam (Babu Tara Kisor Gupta)	30

Series II. DISCIFLORÆ.

Order XXII. LINEÆ.

The Flax Order, chiefly noticeable as containing the Flax plant, *Linum usitatissimum*, L., which is cultivated in Europe for its valuable fibre, used in linen manufacture. In India it is chiefly grown for the linseed oil obtained from its seeds.

There are, in India, four genera containing more or less woody plants, each belonging to a separate tribe. These genera are: Reinwardtia, Hugonia, Erythroxylon and Ixonanthes. The only one of importance is Erythroxylon, a genus in which one species gives a wood of some value.

1. REINWARDTIA, Dumort. *R. trigyna*, Planch. and *R. tetragyna*, Planch. Fl. Br. Ind. i. 412, are, as pointed out by Sir H. Collett, Dr. T. Cooke, and others merely forms of one species, a small shrub with pretty bright yellow flowers, found in the Himalaya and in hilly regions throughout India. Vern. *Basant*, Dehra Dún *Pengun*, Jaunsar; *Pyúra*, Garhwal; *Tila*, Kumaon; *Abai*, Bombay.

Wood white. *Pores* small. *Medullary rays* very fine, very numerous.

2. HUGONIA, Linn.

Two species. *H. ferruginea*, W. and A.; Fl. Br. Ind. i. 413; Trimen Fl. Ceyl. i 190, is a scarce climbing shrub of Ceylon.

1. H. Mystax, Linn.; Fl. Br. Ind. i. 413; Talbot Bomb. List 28; Trimen Fl. Ceyl. i. 189. Vern. *Motira kanni*, Tam.; *Maha-gétiya*, *bugétiya*, Cingh.

A climbing shrub. *Bark* yellowish-white, corky. *Wood* greyish-white, hard, close-grained. *Pores* small, very numerous and evenly distributed. *Medullary rays* very faintly marked, numerous, regular.

Konkan, near the sea coast at Vingorla; Circars and Carnatic; dry region of Ceylon.

D 4167. Velagalapalle, Godavari (Gamble).

3. ERYTHROXYLON, Linn.

Six species. *E. Kunthianum*, Wall.; Fl. Br. Ind. i. 414; Kurz For. Fl. i. 171, is a small tree of Eastern Bengal, the Khasia Hills at 3-5000 ft., the drier hill forests of Martaban and the Thaungyin Hills of Tenasserim up to 7000 ft. *E. lucidum*, Moon; Fl. Br. Ind. i. 415; Trimen Fl. Ceyl. i. 191; Vern. *Chiruchemanatti*, Tam.; *Bata-kirilla*, Cingh., is a shrub of forest undergrowth in the low country of Ceylon. *E. lanceolatum*, Hook. f., and *E. obtusifolium*, Hook. f., also occur in Ceylon, the former extending to Tinnevelly.

The "Coca" or "Spadic" plant of Peru and Bolivia, which gives the well-known alkaloid "Cocaine," now in universal employ as a local anæsthetic, is *E. Coca*, Lam. The leaves are chewed to afford a nervous stimulant which enables the person to endure fatigue. The use of the plant is regular among the Indians of that part of S. America. The *E. Coca* is now cultivated to some extent in India, and the drug appears to be much in use.

1. E. monogynum, Roxb. Fl. Ind. ii. 449; Fl. Br. Ind. i. 414; Kurz For. Fl. i. 171; Trimen Fl. Ceyl. i. 190. *E. indicum*, Bedd. Fl. Sylv. t. 81. Bastard Sandal. Vern. *Devadaru*, *chemanatti*, Tam.; *Adivi gerenta*, *gádara*, *gathara*, *gadiri*, Tel.; *Devadarum*, Kan.

A small tree. *Bark* dark brown, thick, rough. *Wood* very hard: sapwood white; heartwood dark reddish-brown, with a pleasant resinous smell, takes a beautiful polish. *Pores* very small, very numerous, often in radial strings or patches in lighter tissue. *Medullary rays* short, very fine, uniformly distributed.

Dry forests of the Deccan and Carnatic; dry country of Ceylon.

Beddome says, "The wood is used as a substitute for sandalwood" (a curious statement, as I never heard of such a use, and the wood is very unlike sandalwood either in colour, weight or scent), "and an empyreumatic oil or wood tar of a reddish-brown 'colour is procured from it which is used for preserving the wood employed in the 'construction of native boats." It does not, however, seem to be much extracted. The leaves were eaten to a considerable extent in famine seasons in the Ceded Districts, usually cooked, but sometimes raw. Dr. Bidie suggested that "probably they contain 'some principle like that of *E. Coca*," but specimens analyzed by the Govt. Quinologist in Madras proved to have no anæsthetic property, but to possess a bitter tonic principle which might serve to mitigate the pangs of hunger. The fruit is edible and pleasant. The wood is little used, but is strong and hard and pretty. Its weight is about 63 lbs. per cubic foot. It is one of the most useful trees in the dry evergreen forests.

		lbs.
D 1083.	North Arcot Forests (Beddome)	55
D 1091.	Madura Forests "	65
D 2027.	Mysore (Kurz)	67
D 3896.	Ballipalle Forest, Cuddapah (Gamble)	66
D 4067.	Cuddapah (Higgens)	63

2. **E. burmanicum**, Griff.; Fl. Br. Ind. i. 414; Kurz For. Fl. i. 171.

A tree. *Wood* pink, very hard, even-grained, with occasional fine lines of soft tissue. *Pores* small or moderate-sized, scanty, joined by the lines of soft tissue. *Medullary rays* fine, numerous, regular.

Tenasserim and the Andaman Islands.

Singapore—Kew Museum (Ridley).

4. IXONANTHES, Jack. *I. khasiana*, Hook. f.; Fl. Br. Ind. i. 416, is a small tree of the Khasia Hills.

A specimen of *I. icosandra*, Jack, sent by Ridley from Singapore to the Kew Museum, has for structure—

Wood pink, very hard, even-grained, traversed by occasional fine, wavy, not continuous, lines of soft tissue. *Pores* small to moderate-sized, oval. *Medullary rays* very fine, close, numerous, stopping at the pores, the diameter of which is greater than the distance between the rays.

ORDER XXIII. MALPIGHIACEÆ.

Two genera, both containing merely climbing or straggling shrubs.

1. HIPTAGE, Gaertner.

Five species. *H. candicans*, Hook. f.; Fl. Br. Ind. i. 419; Kurz For. Fl. i. 174; Vern. *Taungthawga*, Burm., is described by Kurz as a small deciduous tree of the dry and Eng forests of the Prome District in Burma, extending north to the Kachin Hills and Manipur. *H. obtusifolia*, DC; Kurz For. Fl. i. 173, is a lofty woody evergreen climber, the simple cable-like trunk up to 100 ft. long, rather rare in the tropical forest of the deep ravines of the Pegu Yoma. *H. acuminata*, Wall.; Fl. Br. Ind. i. 419, is a dense bushy shrub of the Khasia Hills at 4000 ft. *H. parvifolia*, W. and A.; Fl. Br. Ind. i. 419; Trimen Fl. Ceyl. i. 193, is a climbing shrub of S. India and Ceylon.

1. **H. Madablota,** Gaertn.; Fl. Br. Ind. i. 418; Brandis For. Fl. 44; Kurz For. Fl. i. 173; Gamble Darj. List 13; Talbot Bomb. List 28; Trimen Fl. Ceyl. i. 193. *Gaertnera racemosa*, Roxb. Fl. Ind. ii. 368. Vern. *Kampti, madmalti*, Hind.; *Endra, chopar, benkar, khumb*, Pb.; *Banda ajári*, Kumaon; *Banda madumalti, aneta, raneta*, Garhwal; *Shempati*, Nep.; *Tungchir*, Lepcha; *Boromali*, Uriya; *Madhava luta*, Jeypore; *Madúbúlúta*, Beng.; *Bokhi, utimukta*, Bombay; *Taungsaga*, Burm.; *Puwak-gédi-ya-wel*, Cingh.

A large straggling climbing shrub, stem often of considerable size. *Bark* brown, thin, exfoliating in small thin flakes. *Wood* reddish-brown, very rough, soft or moderately hard, with darker patches in the centre. *Pores* small to very large, variable, irregularly distributed. *Medullary rays* numerous, moderately broad.

Ravines and valleys in the forests almost throughout India, Burma and Ceylon. Flowers pretty, resembling those of the Horsechestnut.

		lbs.
O 3655, 4569.	Saharanpur Bot. Garden, N.-W. Provinces (Gollan)	38
O 4937.	*Lachiwála, Dehra Dún (Gleadow)*	35

2. ASPIDOPTERYS, A. Juss.

About nine species of climbing shrubs, all small, and interesting only by their having conspicuous winged fruits. *A. Wallichii*, Hook. f.; Fl. Br. Ind. i. 421 (*A. nutans*, A. Juss.; Brandis For. Fl. 45); Vern. *Jugtér*, Dehra Dún, is common in the Garhwal and Kumaon forests and in Dehra Dún. *A. nutans*, Hook. f.; Fl. Br. Ind. i. 421; Gamble Darj. List 13 (*A. lanuginosa*, A. Juss.; Brandis For. Fl. 44); Vern. *Shubung*, Nep.; *Simplút*, Lepcha, is common in the Lower Himalaya.

1. **A. Roxburghiana,** A. Juss.; Fl. Br. Ind. i. 420; Brandis For. Fl. 45; Gamble Darj. List 13; Talbot Bomb. List 29. *Hiræa indica*, Roxb. Fl. Ind. ii. 448. Vern. *Shubung*, Nep.; *Munhuknyok*, Lepcha; *Regrak tiga*, Tel.

A climbing shrub. *Bark* light brown, rough. *Wood* yellowish-brown, soft, porous. *Pores* small to large, often subdivided. *Medullary rays* fine to moderately broad, bent where they touch the pores. Many wavy concentric pale bands across the rays.

Lower Himalaya, from Nepal eastwards; Khasia Hills at 1–5000 ft.; Western Ghâts, Deccan and Carnatic; Orissa and the Circars.

C 3834. Vishnuchakram Forest, Ganjam (Gamble).

Order XXIV. **GERANIACEÆ.**

A large Order chiefly containing herbaceous plants, of which the largest genus is Impatiens, the Balsams. One or two of the species of that genus become almost or quite shrubby, *e.g. I. Leschenaultii*, Wall. and *I. fruticosa*, DC, both of the hills of South India.

1. AVERRHOA, Linn.

Two introduced fruit trees.

The *wood* of the two species is at once distinguished by *A. Bilimbi* having much more scanty *pores* and faint concentric lines. In texture they agree well.

1. **A. Carambola,** Linn.; Fl. Br. Ind. i. 439; Roxb. Fl. Ind. ii. 450; Bedd. Fl. Sylv. xxxix.; Brandis For. Fl. 46; Kurz For. Fl. i. 177; Gamble Darj. List 13;

Talbot Bomb. List 29. Vern. *Kamaranga*, Hind.; *Kamrang*, Beng.; *Kiranelli*, Kan.; *Saungya*, *saungbya*, Burm.

A small tree. *Bark* dark grey, with horizontal folds. *Wood* white, turning light red, moderately hard, close-grained. *Pores* moderate-sized, often subdivided or disposed in short radial lines, scanty, prominent on a vertical section. *Medullary rays* very fine, very numerous and regular, somewhat indistinct.

Cultivated in India and Burma. Talbot says it has run wild in places in North Kanara.

Fruit useful, usually eaten in stews, puddings or tarts, or made into preserve. The juice is used to take out iron-mould stains from linen. Home says it is used in the Sundarbans for building purposes and furniture. Skinner, No. 18, gives the weight at 40 lbs. per cubic foot, and P = 712; Wallich gives the weight at 39 lbs.

		lbs.
O 3658.	Saharanpur Bot. Garden, N.-W. Provinces (Duthie)	—
E 4833.	Khulna, L. Bengal, cult. (T. J. Pocock)	37
E 4919.	Royal Botanic Garden, Calcutta (Prain)	40

2. **A. Bilimbi,** Linn.; Fl. Br. Ind. i. 439; Roxb. Fl. Ind. ii. 451; Brandis For. Fl. 46; Bedd. Fl. Sylv. t. 117; Kurz For. Fl. 178; Talbot Bomb. List 29. Vern. *Bilimbi*, *bhimbu*, *anvalla*, Hind.

A small tree. *Wood* white, tough, soft, very even-grained. *Pores* small or moderate-sized, sometimes subdivided, very scanty. *Medullary rays* extremely fine and indistinct, numerous. Faint pale concentric regular bands.

Cultivated in India and Burma, but much more scarce than *A. Carambola*.

The acid fruit is pickled or preserved in sugar. The juice can be used to remove iron-mould stains from linen.

		lbs.
E 4913.	Royal Bot. Garden, Calcutta (Prain)	35

ORDER XXV. RUTACEÆ.

A large Order, which, however, contains few trees of any size or great importance, but generally herbs, shrubs, climbers or small trees, mostly aromatic, with pellucid glands filled with essential oil. The largest tree of the Order, in India, is probably *Zanthoxylum Rhetsa* of the Northern Circars. Several of the genera, such as *Clausena*, *Citrus*, *Feronia*, *Ægle*, give fruit trees, which are more or less cultivated. Some of the genera, *e.g. Limonia*, *Atalantia*, *Feronia*, *Ægle*, are characteristic of the dry regions, such as those of Central India, the Deccan and Carnatic; but some few belong to the evergreen forests, *e.g. Acronychia*, and one or two to the hill regions only (*Skimmia*, *Melicope*). Of the 18 genera, 11 are represented in North-West and Central India, 13 in the North-East, 15 in Western India, 17 in South India, 17 in Burma, and 14 in Ceylon. They belong to three Tribes, viz.—

Tribe I. Zanthoxyleæ	Evodia, Melicope, Zanthoxylum.
„ II. Toddalieæ	Toddalia, Acronychia, Skimmia.
„ III. Aurantieæ	Glycosmis, Micromelum, Murraya, Clausena, Triphasia, Limonia, Luvunga, Paramignya, Atalantia, Citrus, Feronia, Ægle.

Wood structure very uniform. *Wood* close and even-grained, generally white with a yellowish tinge, of various degrees of hardness. *Pores* small, uniformly distributed, with a tendency to form radial lines. *Medullary rays* fine, uniform and equidistant. The

wood of *Skimmia* is anomalous, being distinguished by extremely small pores, arranged in oblique wavy tails, and by very fine, very numerous medullary rays. The wood of many species is marked by white concentric lines, which are generally at unequal distances and often run into each other.

1. EVODIA, Forst.

Six species. *E. viticina*, Wall.; Fl. Br. Ind. i. 489; Kurz For. Fl. i. 179, is a small evergreen tree of Tavoy. *E. rutæcarpa*, Hook. f. and Th.; Fl. Br. Ind. i. 490, is a small tree of the inner valleys of Sikkim, at 7–10,000 ft.

1. E. Roxburghiana, Benth.; Fl. Br. Ind. i. 487; Kurz For. Fl. i. 180; Talbot Bomb. List 30; Trimen Fl. Ceyl. i. 214. *E. triphylla*, Bedd. Fl. Sylv. xli. *Fagara triphylla*, Roxb. Fl. Ind. i. 416. Vern. *Nebede*, *lunu-ankenda*, Cingh.

A small tree. *Bark* yellowish-grey, rough, ¼ in. thick with deep indentations. *Wood* white, close and even-grained, moderately hard. *Pores* small, surrounded by whitish tissue and arranged in zigzag irregularly concentric lines. *Medullary rays* fine, irregular.

Khasia Hills at 4000 ft.; hills of Western and Southern India, common in the Kanara, Coorg, Wynaad and Nilgiri Forests, up to 7000 ft.; tropical forests of Tenasserim and the Andamans; Ceylon, in the moist country, 2–6000 ft.

Growth slow, about 9 rings per inch of radius.

	lbs.
W 3911, 3926. Cairn Hill Forest, Nilgiris, 7000 ft. (Gamble)	36
W 4080. Nilgiris (Gamble)	—
No. 60, Ceylon Collection, old; No. 101, new (Mendis), very doubtful	51

2. E. triphylla, DC; Fl. Br. Ind. i. 488; Kurz For. Fl. i. 180.

A slender shrub. *Wood* pale red, soft. *Pores* moderate-sized, oval, elongated and subdivided. *Medullary rays* very fine, closely packed.

Hill Forests of Martaban and Tenasserim, 3–5000 ft., Andamans.

B 1979. Andamans (Kurz, 1866).

3. E. fraxinifolia, Hook. f.; Fl. Br. Ind. i. 490; Gamble Darj. List 13. Vern *Kanukpa*, Nep.; *Kanú*, Lepcha.

A small tree. *Bark* smooth, light grey, $\frac{1}{10}$ in. thick. *Wood* white, soft. *Pores* small, often subdivided, numerous near the inner edge of each annual ring, elsewhere scanty. *Medullary rays* short, moderately broad.

Eastern Himalaya in Sikkim, at 4–7000 ft.; Khasia Hills at 3–5000 ft.

A common tree in the Darjeeling Hills. It comes up in second-growth forests and the leaves, flowers and fruit, when bruised, have a disagreeable aromatic smell Growth fast, 4 to 6 rings per inch of radius. The wood is used only for posts of huts.

	lbs.
E 3101. Darjeeling, 7000 ft. (Gamble)	21
E 3641. The Park, Darjeeling, 6500 ft. (Gamble)	—

4. E. melisæfolia, Benth.; Fl. Br. Ind. i. 490. Vern. *Maiphak*, *mipak*, Ass.

A large tree. *Bark* greyish-brown, even. *Wood* yellowish-white when fresh cut, afterwards turning red-brown. *Pores* moderate-sized to large, often subdivided. *Medullary rays* moderately broad, short

tapering gradually at the ends. (Wood more like that of MELIACEÆ than of RUTACEÆ.)

Assam, especially Sibságar District.

This is a tree well known to planters in Assam as making excellent shingles, as it can be so easily split, and one tree can often give as many as 1500 to 2000 of size 18″ × 6″ × 1″. S. E. Peal says that to prepare the shingles, the sapwood should be nearly all removed and the log be then crosscut into drums 18 in. long, which can then be split by a shingle knife at a cost of about Rs.6 per thousand. He further says that the tree is curiously liable to split right up with a loud report if not carefully felled. The Assamese use the wood in looms, as it is strong and light. It is little or not eaten by white ants. Cuts in the bark cause the exudation of amber-coloured beads. The growth is fairly fast, about 7 rings per inch. Altogether, the tree is evidently, though little known, an interesting and useful one, and Mr. Peal deserves thanks for his careful study of it and its uses (see *Ind. Tea Gaz.*, also "Ind. For." vols. x. xi.).

	lbs.
E 3341. Sibságar Dist., Assam (Peal)	27

2. MELICOPE, Forst.

Two species. *M. Helferi*, Hook. f.: Fl. Br. Ind. i. 492, is a diœcious shrub of the Andaman Islands.

1. **M. indica,** Wight; Fl. Br. Ind. i. 492; Bedd. Fl. Sylv. xl.

A large shrub. *Bark* blackish-grey, rough, corky, with slender short horizontal lines. *Wood* white, hard, close-grained, with numerous white, irregularly-spaced, fine concentric lines. *Pores* small, usually single or in pairs, often joined by very short white concentric lines. *Medullary rays* white, fine, numerous, wavy, regularly distributed.

Nilgiri Hills, woods near Avalanché, 7–8000 ft.

W 4261. Near Avalanché, Kundahs, Nilgiris, 7000 ft. (Gamble).

3. ZANTHOXYLUM, Linn.

About eleven species. *Z. tomentellum*, Hook. f.; Fl. Br. Ind. i. 493, is a small tree of the Eastern Himalaya at about 5000 ft. *Z. khasianum*, Hook. f.; Fl. Br. Ind. i. 494, is "a small very fragrant climbing straggling bush" of the Khasia Hills at 4–6000 ft. *Z. andamanicum*, Kurz For. Fl. i. 181, is a straggling shrub of the Andaman Islands.

Wood light, soft, white or yellowish-white. *Pores* small, rather scanty. *Medullary rays* fine, numerous, evenly distributed.

1. **Z. ovalifolium,** Wight; Fl. Br. Ind. i. 492; Bedd. Fl. Sylv. xlii.; Gamble Darj. List 13; Talbot Bomb. List 30.

A shrub. *Bark* thin, grey-brown, with white vertical streaks. *Wood* light yellowish-white, very hard, close-grained. *Pores* very small, rather scanty, evenly distributed. *Medullary rays* fine, very numerous. Numerous sharp, white, concentric lines, as in *Murraya exotica*, which it much resembles in structure.

Eastern Himalaya; Khasia Hills, Assam and Upper Burma; Western Ghâts.

	lbs.
E 3353. Sivoke Hills, Darjeeling, 1500 ft. (Gamble)	54

2. **Z. alatum,** Roxb. Fl. Ind. iii. 768; Fl. Br. Ind. i. 493; Bedd. Fl. Sylv. xlii.; Brandis For. Fl. 47; Gamble Darj. List 14. Vern. *Timbúr, timur, tezmal, dúrmúr,*

Hind.; *Tezbal, tejmal*, Garhwal; *Timbúr, timru, temru*, Jaunsar; *Balay timur*, Nep.; *Gaira*, Monghyr; *Sungrú*, Lepcha.

A shrub or small tree. *Bark* corky, young stems with thick conical prickles from a corky base. *Wood* close-grained, yellow. *Pores* small, often in radial lines, not uniformly distributed; belts with numerous pores often alternating with belts with scanty pores. *Medullary rays* fine, short, very numerous.

Outer Himalaya from the Indus to Bhutan, ascending to 7000 ft.; Khasia Hills.

The wood is used for walking-sticks, the branches for making tooth-brushes. The fruit is a remedy for toothache, and is also used to purify water and as a condiment. The whole plant has a strong unpleasant aromatic smell.

		lbs.
H 107.	Bhajji, Simla, 4000 ft.	46
E 2329.	Tukdah, Darjeeling, 5000 ft. (Gamble)	34

3. Z. acanthopodium, DC; Fl. Br. Ind. i. 493; Kurz For. Fl. i. 181; Gamble Darj. List. 14. Vern. *Bogay timur*, Nep.; *Timbúr, tembar*, Lepcha.

A small tree. *Bark* ⅛ in. thick, greyish-brown, shining, studded with the large conical corky bases of the prickles, which fall off as the tree grows. *Wood* yellowish-white, soft. *Pores* small, often in short radial lines. *Medullary rays* fine, numerous.

Outer Himalaya from Kumaon to Sikkim, and the Khasia Hills, up to 7000 ft.; Upper Burma in the Chin and Kachin Hills.

A common small tree in second-growth forest. Growth fast; the specimen (a round) shows 11 rings on a mean radius of 2½ in., or 4·4 rings per inch of radius.

E 3415. The Park, Darjeeling, 6500 ft. (Gamble).

4. Z. oxyphyllum, Edgew.; Fl. Br. Ind. i. 494; Gamble Darj. List 14. Vern. *Timur*, Nep.

A climbing shrub. *Bark* greyish-brown, covered with large corky lenticels, and armed with recurved thorns on a conical corky base, often ¾ in. high. *Wood* yellowish-white, soft, porous. *Pores* large, usually many times subdivided radially. *Medullary rays* moderately broad, bent where they pass the pores. *Annual rings* marked by a white line.

Himalaya from Garhwal to Bhutan, at 6–8000 ft.; Khasia Hills, 4–6000 ft.

E 3375. Darjeeling, 6500 ft. (Gamble).

5. Z. Hamiltonianum, Wall.; Fl. Br. Ind. i. 494; Kurz For. Fl. i. 181; Gamble 14. Vern. *Purpuray timur*, Nep.

A climbing thorny shrub. *Bark* dark grey with white lenticels, armed with short recurved prickles on a thick, nearly cylindrical corky base, often ¾ in. high. *Wood* yellowish-white, soft. *Pores* fine, not numerous. *Medullary rays* fine to moderately broad, numerous, nearly equidistant.

Sikkim, Assam, Upper Burma.

E 3416. The Park, Darjeeling, 6500 ft. (Gamble).

6. Z. tetraspermum, W. and A.; Fl. Br. Ind. i. 494; Bedd. Fl. Sylv. 42; Trimen Fl. Ceyl. i. 215.

A climbing thorny shrub. *Bark* brown, with short recurved thorns on a thick conical laterally-compressed corky base ½ in. high. *Wood* yellowish-white, soft. *Pores* moderate-sized, often subdivided,

joined by faint concentric lines of white tissue. *Medullary rays* fine, numerous.

Hills of S. India and Ceylon at 4–6000 ft.

W 3767. Lamb's rock Shola, Nilgiris, 6000 ft. (Gamble).

7. Z. Rhetsa, DC; Fl. Br. Ind. i. 495; Bedd. Fl. Sylv. xli.; Talbot Bomb. List 30. *Fagara Rhetsa*, Roxb. Fl. Ind. i. 417. Vern. *Tirphal, tisul, cochli,* Mar.; *Jummina*, Kan.; *Pepuli*, Hind.; *Rhetsa*, Reddi; *Rhetsa mán*, Tel.; *Mulillam*, Mal.; *Ratu kina*, Cingh.

A large tree. *Bark* cream-coloured, with thick cork in irregular masses, studded with conical spines about 2 in. long and the same in base diameter. *Wood* yellowish-grey, moderately hard, close-grained. *Pores* small, rather scanty, single or in radial strings of 2 to 4. *Medullary rays* short, white, numerous, the distance between them about equal to the diameter of the pores. *Annual rings* distinctly marked by the darker autumn wood with few pores.

Hills of the Eastern Gháts, especially Rumpa and about the Godavari; Konkan and North Kanara in deciduous forest; Anamalai and other Western Ghát forests and Travancore.

A fine tree which grows to be 80 to 100 ft. high and 6 to 8 ft. in girth in the Rumpa Hills. The specific name *Rhetsa* is the name given by the Reddis or hill men of Rumpa, which is probably the locality whence Roxburgh (who lived close by, at Samulkotta) first received it. He explains that *Rhetsa* = committee, and *mán* a large tree, and notes that it is under the shade of this tree that the hill men assemble for "punchayets," or to discuss affairs. The seeds taste like black pepper.

	lbs.
C 3952 (young), 3962 (old). Rumpa Hills, Godavari (Gamble) . .	40

8. Z. Budrunga, DC; Fl. Br. Ind. i. 495; Kurz For. Fl. i. 182. *Fagara Budrunga*, Roxb. Fl. Ind. i. 417. Vern. *Brojonáli*, Ass.; *Mayanin*, Burm.

A tree with greyish-brown *bark;* young stems covered with thick conical prickles from a corky base. *Wood* moderately hard, close-grained, white. *Pores* small, uniformly distributed, often in short radial lines. *Medullary rays* fine, short, numerous.

Eastern Himalaya, Khasia Hills, Eastern Bengal and Burma.

A pretty tree. When young the stems are leafless to the top, where the long pinnate leaves are put out umbrella-fashion. I have never seen it of large size, but Kurz says that in Burma it grows to 50 or 60 ft. high and 5 to 6 ft. in girth. Seeds aromatic.

E 3324. Pankabari, Darjeeling, 2000 ft. (Gamble).

4. TODDALIA, Juss.

Contains two species: one the rambling, sarmentose shrub here described; the other *T. bilocularis*, W. and A.; Fl. Br. Ind. i. 497; Bedd. Fl. Sylv. xliii.; Talbot Bomb. List 21, a handsome tree of the Western Gháts, of Bombay and Madras, always unarmed and reaching 3 ft. in girth.

1. T. aculeata, Pers.; Fl. Br. Ind. i. 497; Bedd. Fl. Sylv. xlii.; Brandis For. Fl. 46; Kurz For. Fl. i. 183; Gamble Darj. List 14; Talbot Bomb. List 21; Trimen Fl. Ceyl. i. 215. *Scopolia aculeata*, Sm.; Roxb. Fl. Ind. i. 616. Vern. *Kánj*, Hind.; *Dahan, lahan*, Rajputana; *Meinkara*, Nep.; *Saphiji*, Lepcha; *Milkaranai, kitchili, kandai*, Tam.; *Kondakashinda*, Tel.; *Tundupara, han mochu*, Uriya; *Kudumiri*, Cingh.; *Kyanza*, Burm.

A large scandent shrub, the branches covered with prickles on broad corky cones often 1 in. high. *Bark* brown, thin with prominent lenticels. *Wood* porous, yellowish-white, soft. *Pores* moderate-

sized, often subdivided, uniformly distributed. *Medullary rays* very fine, uniform and equidistant, bent where they touch the pores.

Outer Himalaya from Dehra Dún eastwards; Khasia Hills; Western Ghâts ascending to 7000 ft.; Ceylon and Burma.

This is more usually a climber, but may often be found as an erect shrub on the hills of S. India. It merely differs according to soil; in the damp forests of Dehra Dún, Sikkim and Nilgiris it is a large climber, but on the dry hills of the Deccan and Carnatic, or on the dry slopes of the Nilgiris, etc., it is a straggling or erect shrub The wood also differs naturally for the same reasons. The hooked thorns are very strong, and a thicket of it is very difficult to penetrate. The root bark gives a yellow dye and a bitter and aromatic tonic, used by natives in some parts of the country as a remedy for fever (*Bidie*).

	lbs.
E 2855. Tukdah, Darjeeling, 5000 ft. (Gamble)	—
W 3795, 3857, 4041. Ootacamund, Nilgiris, 7500 ft. (Gamble)	40
W 3759. Coonoor, Nilgiris, 6000 ft. (Gamble)	—

5. ACRONYCHIA, Pers.

1. **A. laurifolia,** Bl.; Fl. Br. Ind. i. 498; Kurz For. Fl. i. 184; Gamble Darj List 14; Talbot Bomb. List 31; Trimen Fl. Ceyl. i. 216. *A. pedunculata*, DC; Bedd Fl. Sylv. xlii. Vern. *Paowlay*, Nep.; *Loajan*, Ass.; *Mutta-nari*, Mal.; *Ankenda* Cingh.

An evergreen tree. *Bark* grey, granular. *Wood* white or greyish-white, soft to moderately hard, smooth. *Pores* moderate-sized, sometimes subdivided, scanty, irregularly distributed in more or less concentrically arranged groups. *Medullary rays* fine, irregularly spaced, not numerous.

Evergreen forests, river-banks and ravines: in the sub-Himalayan tract from the Dehra Dún to Assam; Eastern Bengal and Burma; Andaman Islands; West and South India and Ceylon: up to 5000 ft.

The wood is but little used. The leaves and bark are used in medicine.

	lbs.
O 4838. Dehra Dún, N.-W. Provinces (U. N. Kanjilal)	47
No. 4, Ceylon Collection, new (Mendis).	

6. SKIMMIA, Thunb.

1. **S. Laureola,** Hook. f.; Fl. Br. Ind. i. 499; Brandis For. Fl. 50; Gamble 14 Vern. *Ner, barru, shushri, pátrang*, Pb.; *Kastura, kathurchára*, Jaunsar; *Narpati* Garhwal; *Narlú*, Dotiál; *Nehar, gurlpata, nayalpati*, Kumaon; *Chumlani*, Nep. *Timburnyok*, Lepcha.

An extremely aromatic shrub. *Bark* thin, bluish-grey. *Wood* white, soft, with distinct, white, concentric lines which may possibly be annual rings; has an aromatic scent when fresh cut. *Pores* extremely small, in narrow, irregularly bent tails. *Medullary rays* fine, numerous.

Himalaya from the Indus to Bhutan at 5–11,000 ft., Afghanistan.

An undershrub in the oak and fir forests. The leaves are eaten in the Himalaya in curries; their scent is almost exactly that of the musk of the Musk deer (*Kastúri*).

	lbs.
H 2846. Mahasu, Simla, 8000 ft. (Gamble)	—
E 2330. Tukdah, Darjeeling, 5000 ft. ,,	42
E 3293. Mahalderam, Darjeeling, 7000 ft. (Gamble)	—

I believe that the Darjeeling plant, to which Nos. E 2330, 3293 belong, is different species to the North-West Himalayan one. The latter is a low tufted bus

with close heads of yellow flowers and yellow berries, while the Darjeeling one is a large shrub with loose panicles of whitish flowers and black berries.

7. GLYCOSMIS, Correa.

Two species are described in the Fl. Br. Ind., one of which is a rare endemic Ceylon plant; Kurz has added three more, among which the most noticeable is *G. arborea*, Roxb.: Kurz For. Fl. i. 185, an evergreen tree of the forests of the Andamans.

1. **G. pentaphylla,** Correa; Fl. Br. Ind. i. 499; Bedd. Fl. Sylv. xliii.; Brandis For. Fl. 49; Kurz For. Fl. i. 186; Gamble Darj. List 14; Talbot Bomb. List 31; Trimen Fl. Ceyl. i. 217. *Limonia pentaphylla*, Roxb. Fl. Ind. ii. 364. Vern. *Ban-nimbu, potla, potali, pilru-potala, girgitti*, Hind.; *Ash-shoura*, Beng.; *Kirmiru*, Bombay; *Chouldua*, Uriya; *Laker-konta*, Monghyr; *Kula-pannai*, Tam.; *Gulunga*, Tel.; *Tawshauk*, Burm.

A shrub or small tree. *Bark* light greyish-yellow. *Wood* white, hard, close-grained. *Pores* small, sometimes subdivided or arranged in radial lines. *Medullary rays* fine, wavy, very numerous. Sharp concentric white lines, often running into each other, very prominent.

Throughout India, Burma and Ceylon, except in very dry regions.

A very variable shrub, of which there are many varieties. It is common in the undergrowth of forests, or still more so of mango topes, and bamboo groves, and under hedgerow trees near villages.

E 3284. Chittagong (Gamble).

8. MICROMELUM, Blume.

Two species. *M. hirsutum*, Oliv.; Fl. Br. Ind. i. 502; Kurz For. Fl. i. 187, is a low shrub of the dry forests of Burma.

1. **M. pubescens,** Bl.; Fl. Br. Ind. i. 501; Bedd. Fl. Sylv. xliii.; Kurz For. Fl. i. 186; Gamble Darj. List 15; Trimen Fl. Ceyl. i. 218. Vern. *Lasmani*, Nep.; *Kambrong*, Lepcha; *Kakaipalai*, Tam.; *Wal-karapincha*, Cingh.; *Tanyinbo*, Burm.

A small evergreen tree. *Bark* thin, white. *Wood* yellowish-white, hard, close-grained. *Pores* small, scanty, often subdivided. *Medullary rays* fine, sharply marked. Sharp white concentric lines, often running into each other, prominent.

Central and Eastern Himalaya; Assam, Khasia Hills and Chittagong; N. Circars; Western Coast; Burma, Ceylon and the Andamans.

E 3355. Tista Valley, Darjeeling (Gamble).

9. MURRAYA, Linn.

Four species. One is a shrub of Upper Burma, little known, *M. elongata*, DC; another, *M. Gleniei*, Thw.; Trimen Fl. Ceyl. i. 220, t. 22, is a Ceylon species, rather rare.

Wood hard, yellowish- or greyish-white. *Pores* small. *Medullary rays* fine. The woods of the two species differ considerably.

1. **M. exotica,** Linn.; Fl. Br. Ind. i. 502; Roxb. Fl. Ind. ii. 374; Bedd. Fl. Sylv. xliv.; Brandis For. Fl. 48; Kurz For. Fl. i. 190; Gamble Darj. List 15; Talb. Bomb. List 31; Trimen Fl. Ceyl. i. 219. Vern. *Marchula, juti, atul*, Hind.; *Marchi*, Kumaon; *Juti mersolo*, Garhwal; *Bilgar*, Debra Dún; *Kamini*, Beng.; *Naga golunga*, Tel.; *Kunti*, Bombay; *Raket-berár*, Gondi; *Simali*, Nep.; *Shitzem*, Lepcha; *Thanatka*, Burm.; *Machalla*, And.; *Etteriya*, Cingh.

A shrub or small tree. *Bark* thin, grey. *Wood* light yellow,

like boxwood, close-grained, very hard, apt to crack. *Pores* very small, sometimes in short radial lines of 2 or 3. *Medullary rays* very fine, very numerous. Sharp, white, concentric lines, which frequently run into each other, unevenly spaced, roughly about 40 to 50 per inch.

Outer Himalaya from the Jumna to Assam, ascending to 4500 ft.; Behar; South and West India; Burma and the Andaman Islands. Usually in underwood in ravines in the forest.

The wood resembles boxwood, and has been tried for wood-engraving, for which it seems suitable if well seasoned; it is also used for the handles of tools, for cabinets and walking-sticks. It is often planted for ornament, and is sometimes called "satin-wood" at Port Blair, where it apparently grows to a considerable size, giving squares of 10 ft. long and 4 in. siding (Heinig).

Weight: 62 lbs. per cubic foot is the average of the specimens; Wallich gives 61 lbs.

		lbs.
C 3495.	Kolhán Forests, Singbhúm (Gamble)	—
C 3949.	Rumpa Forests, Godavari, 3000 ft. (Gamble)	—
B 3195.	Andaman Islands (Home, 1874, No. 24)	63
B 519.	„ „ (Gen. Barwell)	62
No. 26, Ceylon Collection, old; No. 32, new (Mendis)		61

2. **M. Königii**, Spr.; Fl. Br. Ind. i. 503; Bedd. Fl. Sylv. xliv.; Brandis For. Fl. 48; Kurz For. Fl. i. 190; Gamble Darj. List 14; Talbot Bomb. List 31; Trimen Fl. Ceyl. i. 220. *Bergera Königii*, Linn.; Roxb. Fl. Ind. ii. 375. Vern. *Gandla, gandi, bowala*, Pb.; *Harri, katním*, Hind.; *Gonti*, Kumaon; *Gondela, gani*, Garhwal; *Barsanga*, Beng.; *Chanangi*, Hyderabad; *Gant*, Banda; *Humwah*, Mechi; *Karsepak, karepak, kari-vepa*, Tel.; *Kamwepila, karivempu*, Tam.; *Kari-bévu*, Kan.; *Karapincha*, Cingh.; *Kyaung thwè*, Burm.

A small tree. *Bark* grey with shallow netted fissures. *Wood* greyish-white, hard. *Pores* small, sometimes subdivided or arranged in patches of light tissue in a somewhat zigzag concentric pattern. Pores in some lines (? annual rings) almost continuous. *Medullary rays* fine, very numerous. Concentric white lines less strongly marked than in *M. exotica*.

Outer Himalaya from the Ravi to Assam; Bengal, South and West India and Burma.

The wood is durable, and is used for agricultural implements. The leaves are used to flavour curries.

		lbs.
O 3265.	Saharanpur Bot. Garden (Duthie)	43
D 3798.	Ballipalle Forests, Cuddapah (Gamble)	—

10. CLAUSENA, Burm.

Nine species. *C. pentaphylla*, DC; Fl. Br. Ind. i. 503; Brandis For. Fl. 49 (*Amyris pentaphylla*, Roxb. Fl. Ind. ii. 247); Vern. *Rattanjote, surjmukha, teyrúr*, Hind., is a pretty, deciduous, aromatic shrub of the forests of the North-Western Provinces, in Kumaon and Oudh. *C. indica*, Oliv.; Fl. Br. Ind. i. 505; Bedd. Fl. Sylv. xlv.; Talbot Bomb. List 32; Trimen Fl. Ceyl. i. 221. Vern. *Karivappilei*, Tam.; *Gorakotta*, Trav. Hills, is a small tree of the forests of the Western Coast and Ceylon, whose leaves are aromatic and eaten in curries.

1. **C. excavata**, Burm.; Fl. Br. Ind. i. 504; Kurz For. Fl. i. 188; Gamble Darj. List 15.

A shrub or small tree. *Bark* thin, smooth, dark brown. *Wood* white, soft. *Pores* small, scanty, often in pairs or short radial lines.

Medullary rays fine, numerous. White concentric lines often interrupted, but very closely packed radially.

Eastern sub-Himalayan tract, Eastern Bengal and Burma.

E 3354. Sivoke, Darjeeling Terai (Gamble).

2. **C. Willdenovii,** W. and A.; Fl. Br. Ind. i. 506; Bedd. Fl. Sylv. xliv.; Gamble Darj. List 15; Talbot Bomb. List 32; Trimen Fl. Ceyl. 222. Vern. *Madanay*, Nep.; *Terhilnyok, sidemnyok*, Lepcha; *Mor kurangi*, Kader; *Weda-pana*, Cingh.

A small tree. *Wood* white, hard, close-grained, resembling boxwood. *Pores* small, scanty, in patches or more or less concentric lines of light tissue. *Medullary rays* fine, white, not very numerous, short. *Annual rings* marked by a light band made up of several of the concentric lines referred to.

Sikkim Himalaya up to 2000 ft.; Western Ghâts from the Konkan southwards ascending to 3000 ft.; drier parts of Ceylon.

The leaves are aromatic with a scent of aniseed. Beddome says the fruit is "very delicious, as large as a large cherry, as succulent as a grape, and somewhat of 'the flavour of the black currant." It is strange that such a wonderful fruit should not be in regular cultivation, while the "*Wampi*," which is just a sub-acid very small cross between an orange and a lime, should be common in orchards.

		lbs.
W 4719.	Travancore (Bourdillon)	61

3. **C. Wampi,** Blanco; Fl. Br. Ind. i. 505; Kurz For. Fl. i. 189. *Cookia punctata*, Sonn.; Roxb. Fl. Ind. ii. 382. Vern. *Wampi* = *whung-pi*, Chinese; *Ampeach*, Dehra Dún.

A small tree. *Bark* grey, thin. *Wood* white, hard, close-grained. *Pores* small, numerous, fairly evenly distributed between the fine, white, numerous, *medullary rays*. Distant concentric white lines which look like annual rings, but probably are not, as they are not continuous.

A cultivated fruit tree: introduced from China.

A pleasant sub-acid fruit, like a very small lime, with large seeds and a flavour of orange. Would be excellent for preserves, but is apparently not very well known.

		lbs.
O 4745.	Forest School Garden, Dehra Dún, N.-W. P. (Babu Birbal)	57

11. TRIPHASIA, Lour. *T. trifoliata*, DC; Fl. Br. Ind. i. 507; Kurz For. Fl. i. 192; Talbot Bomb. List 32, is a small thorny shrub, found in gardens throughout India, and as an escape. It is a native of China. The fruit is eaten and is made into preserves and pickles in China. Prain records it even from Car Nicobar.

12. LIMONIA, Linn.

Three species. *L. alternans*, Wall.; Fl. Br. Ind. i. 508; Kurz For. Fl. i. 192, is a slender unarmed shrub of the upper mixed and occasionally of the moist forests of the Pegu Yoma, usually gregarious.

Wood hard, light yellow, close-grained. *Pores* very small. *Medullary rays* very fine and numerous. Prominent concentric white lines.

1. **L. acidissima,** Linn.; Fl. Br. Ind. i. 507; Bedd. Fl. Sylv. xlv.; Brandis For. Fl. 47; Kurz For. Fl. i. 192; Talbot Bomb. List 32. *L. crenulata*, Roxb. Fl. Ind. ii. 381; Trimen Fl. Ceyl. i. 223. Vern. *Beli*, Hind.; *Tor-elaga*, Tel.; *Kawat*, Mar.; *Bharassi*, Jeypore; *Keiri, kari*, Merwara; *Belsian*, Palamow; *Bhenta*, Uriya; *Naibela*, Kan.; *Thihaza, thanatka*, Burm.

A tree or small tree, thorny. *Bark* thin, light brown, corky, slightly cleft vertically. *Wood* very hard, like boxwood, yellowish-white, often darker, sometimes even dark olive-grey in the centre. *Pores* small, surrounded by pale tissue, solitary or arranged in oblique strings. *Medullary rays* very fine, numerous, uniform and equidistant. Numerous concentric rings marked by white lines as in *Murraya exotica*, though not so markedly anastomozing.

Outer North-West Himalaya up to 4000 ft.; Monghyr, Sonthal, and other forests in Behar; drier forests in Assam; Upper Burma forests down to Prome; Central Provinces, Chota Nagpore, Orissa, Circars, Deccan and Carnatic, common in dry deciduous forests. Scarce in Ceylon.

Trimen has explained that the proper name of this tree should be *Hesperethusa crenulata*, Röm., but as this is not a critical botanical work, I prefer to adhere to the old name. The tree is an interesting one; the wood is a very likely substitute for boxwood, and as such was sent to the Edinburgh Forestry Exhibition in 1884, but no report was received. Brandis says it is used for the axles of oil-pressers and for rice-pounders, and is a good fuel; also that the fruit is used in native medicine, and as an antidote to venomous poisons. Growth variable, 3 to 10 rings per inch.

		lbs.
C 3530, 3570.	Khurdha Forests, Orissa (Gamble)	61
C 3645.	Palamow Forests (Gamble)	—
C 3822.	Surada Forests, Ganjam (Gamble)	63
C 3846.	Kurcholy Forest, Gumsúr „	59
O 4565.	Saharanpur Bot. Garden (Gollan)	61

2. **L. alata,** W. and A.; Fl. Br. Ind. i. 508; Bedd. Fl. Sylv. xlv.; Trimen Fl. Ceyl. i. 223. Vern. *Tumpat-kurundu*, Cingh.

A small tree. *Bark* $\frac{1}{8}$ to $\frac{1}{4}$ in., brown, nearly smooth. *Wood* yellow, hard, close- and even-grained. *Pores* very small, more scanty than in *L. acidissima*. *Medullary rays* very fine, clear, numerous and equidistant. Concentric lines sharp, white, narrower than in *L. acidissima*. The wood is almost exactly that of *Murraya exotica*.

South India and Ceylon, chiefly in dry country like the Deccan and Carnatic.

		lbs.
D 4161.	Dornál Forests, Kurnool (Gamble)	64

13. LUVUNGA, Hamilt. Two climbing shrubs. *L. scandens*, Ham.; Fl. Br. Ind. i. 509 (*Limonia scandens*, Roxb. Fl. Ind. ii. 380), is a large thorny scandent shrub of Eastern Bengal; and *L. eleutherandra*, Dalz.; Fl. Br. Ind. i. 509; Talbot Bomb. List 32; Trimen Fl. Ceyl. i. 224, is a large thorny climber of the Western Ghâts and Ceylon.

14. PARAMIGNYA, Wight.

Five shrubs or climbers of Eastern Bengal or Burma, mostly of but little consequence. *P. longispina*, Hook. f. is, according to Heinig in Sundarbans Working Plan, a thorny undershrub; Vern. *Ban-nebu*, Beng.

1. **P. monophylla,** Wight; Fl. Br. Ind. i. 510; Kurz. For. Fl. i. 193; Gamble Darj. List 15; Talbot Bomb. List 33; Trimen Fl. Ceyl. i. 224. Vern. *Natkanta*, Nep.; *Jhunok*, Lepcha; *Kurwa wagutti*, Mar.; *Ranyeed*, Bombay; *Wellangiriya*, Singh.

A stout, climbing, evergreen shrub. *Bark* white, corky, vertically cleft. *Wood* white, hard, close-grained. *Pores* very small to moderate-sized. *Medullary rays* very fine, extremely numerous. Prominent, sharp, white, concentric lines at unequal distances and often joining each other.

N.-E. Himalaya at 2–5000 ft.; Khasia Hills; Burma; W. and S. India and Ceylon.

E 3295. Babookhola, Darjeeling, 5000 ft. (Gamble).

15. ATALANTIA, Correa.

Contains six small trees of South India, Ceylon and Burma. *A. racemosa*, W. and A.; Fl. Br. Ind. i. 512; Bedd. Fl. Sylv. xlvi.; Talbot Bomb. List 33; Trimen Fl. Ceyl. i. 226; Vern. *Katta narayam*, Tam., is a small tree of South India and Ceylon; *A. caudata*, Hook. f.; Fl. Br. Ind. i. 513, a shrub of the Khasia Hills; and *A. macrophylla*, Kurz For. Fl. i. 195, an evergreen tree of the coast forests of the Andamans. *A. zeylanica*, Oliv.; Fl. Br. Ind. i. 512; Bedd. Fl. Sylv. xlvi.; Talbot Bomb. List 33; Trimen Fl. Ceyl. i. 227; Vern. *Peykuruntu*, Tam.; *Yakinaran*, Cingh., is a small tree or branching bush of the Western Ghâts of S. India and the low country of Ceylon.

1. A. monophylla, Correa; Fl. Br. Ind. i. 511; Bedd. Fl. Sylv. xlvi.; Kurz For. Fl. i. 195; Talbot Bomb. List 33; Trimen Fl. Ceyl. i. 226. Vern. *Arawi nim*, Tel.; *Katyalu*, Tam.; *Ran limbu*, *makúr limbu*, Mar.; *Narguni*, *kata narunga*, Uriya; *Motameri*, Palkonda; *Perunkuruntu*, Tam.

A small tree. *Wood* yellow, very hard and close-grained. *Pores* very small; single or in pairs in radial lines. *Medullary rays* very fine, numerous; the distance between the rays greater than the transverse diameter of the pores. Numerous white concentric lines at varying distances. The wood much resembles that of *Murraya exotica.*

Sylhet in Eastern Bengal; dry evergreen forests of the Deccan and Carnatic in Southern India; dry region of Ceylon; Upper Burma.

The wood is recommended by Kurz as a substitute for boxwood, and for cabinet work and turning, a recommendation which I fully endorse. A considerable number of the small trees of this Order which occur mostly in the dry evergreen forests of the Deccan and Carnatic have woods suitable for engraving purposes, especially *Murraya*, *Limonia* and *Atalantia*. They have never had the trial they deserve. When sending specimens to the Edinburgh Forestry Exhibition in 1884, a set of 16 species, including *A. monophylla*, was sent from the Madras Forests, and it was asked that they might be reported on, but no notice was taken of the request (see Exh. Cat. N.C. Madras, p. 7).

	lbs.
C 3515. Khurdha Forests, Orissa (Gamble)	—
C 3888. Gumsúr Forests, Ganjam „	56
No. 10, Salem Collection	65

2. A. missionis, Oliv.; Fl. Br. Ind. i. 513; Bedd. Fl. Sylv. xlvi.; Talbot Bomb. List 33; Trimen Fl. Ceyl. i. 227. Vern. *Kuruntu*, Tam.; *Pambúrú*, Cingh.

A small tree. *Wood* yellowish-white, moderately hard, close-grained. *Annual rings* marked by a white line and a belt of more numerous pores. *Pores* small, uniformly distributed. *Medullary rays* fine, wavy, very numerous, uniform, not equidistant.

South India and Ceylon, in dry evergreen forest.

The wood is used for furniture and cabinet work; it is sometimes variegated (Mendis).

	lbs.
No. 66, Ceylon Collection, old; No. 108, new (Mendis)	48

16. CITRUS, Linn.

I do not propose here to go into the difficult question of the forms of the different cultivated or semi-wild species of Citrus. Those who are interested in the subject can consult the excellent account of the genus given in Brandis "Forest Flora," the

arrangement of which has been followed by Hooker in the "Fl. Br. Ind." The question has been much studied by Dr. Bonavia, and a very full account of the various opinions and the information up to date is recorded in Dr. Watt's Dictionary, vol. ii. I propose to consider the woods under the three species as described in the "Fl. Br. Ind." *C. medica*, Linn., the Citron, Lemon, Sour Lime and Sweet Lime; *C. Aurantium*, Linn., the Orange, and *C. decumana*, Linn., the Pumelo or Shaddock. Besides these, *C. Hystrix*, DC; Fl. Br. Ind. i. 515; Kurz For. Fl. i. 196; Trimen Fl. Ceyl. i. 228; Vern. *Shankpôt*, Burm., is a shrub of the Khasia hills, found in woods at the Living Bridge, Moflong and Myrung at 2–5000 ft.; in the hills of Martaban and Tenasserim in Burma; and (probably this species) wild or semi-wild in the east of Ceylon. *C. japonica*, Thunb. is the "Kumquat," well known from Chinese preserves, but not usually cultivated in India.

1. C. medica, Linn.; Fl. Br. Ind. i. 514; Brandis For. Fl. 51; Kurz For. Fl. i. 197; Gamble Darj. List 15; Talbot Bomb. List 33. Vern. *Shankthakwa*, Burm.

Var. 1. *medica* proper. The Citron. Vern. *Bejaura*, Hind.; *Begpura*, Beng.; *Karanphal*, Kumaon.
Var. 2. *Limonum*. The Lemon. Vern. *Bara nimbu*, Hind.; *Korna nebu*, Beng.
Var. 3. *acida*. The Sour Lime. Vern. *Lebu*, *nebu*, *limbu*, *nimbu*, Hind., Beng.
Var. 4. *Limetta*. The Sweet Lime. Vern. *Mitha nebu*, Hind.; *Amritphal*, Kumaon.

A shrub. *Bark* yellowish-white, thin. *Wood* light yellow, moderately hard. *Pores* small, subdivided or in small radial groups of 1 to 3, occasionally joined by faint tangential lines. *Medullary rays* fine, numerous. Concentric white lines distant.

Wild in places throughout India: valley of Dehra Dún and Lower Himalaya east to Sikkim; hills of the C.P. near Pachmarhi; Western Gháts; Sitakund hill near Chittagong; Khasia Hills. Cultivated everywhere.

		lbs.
O 4812.	Nakraunda Swamp, Dehra Dún (Gamble)	52
E 3348.	Darjeeling Hills (Gamble)	—

Nordlinger's Sections, vol. 11 (*C. medica*, L. and *C. Limonium*, Riss.).
Hough's "American Woods," vol. v. No. 104 (*C. Limonium*).

2. C. Aurantium, Linn.; Fl. Br. Ind. i. 515; Brandis For. Fl. 53, 572; Kurz For. Fl. i. 197; Gamble Darj. List 15; Talbot Bomb. List 34. The Orange. Vern. *Narangi*, *naringi*, *santara*, *kamla nebu*, Hind.; *Jairum*, Kumaon; *Janmera*, *jamera*, Garhwal; *Suntala*, Nep.; *Silum*, Lepcha; *Narangi*, Mar.; *Kitchli*, Tam.; *Kittali*, Tel.; *Shaungpang*, Magh.; *Leinmaw*, Burm.

A small tree. *Bark* thin, greenish-grey. *Wood* yellowish-white, moderately hard, close and even-grained. *Pores* small, scanty, joined, as in *C. medica*, by white tangential lines, only here they are more conspicuous; they occasionally join, forming concentric circles. *Medullary rays* fine, very numerous, equidistant.

Wild, or apparently so, in valleys in Garhwal, Kumaon, Sikkim and the Khasia Hills, up to about 4000 ft.; also E. slopes of Nilgiris. Cultivated everywhere.
Skinner, No. 48, gives W = 49 lbs., P = 767.
E 3371. Rajabhatkhawa, W. Dúars (Gamble).
Nordlinger's Sections, vol. 4; also vol. 11 (*C. vulgaris*, Riss. and *C. nobilis*, Lour.).
Hough's "American Woods," vol. v. No. 103.

3. C. decumana, Linn.; Fl. Br. Ind. i. 516; Roxb. Fl. Ind. iii. 393; Brandis For. Fl. 55; Gamble Darj. List 15; Talbot Bomb. List 34. The Pumelo or Shaddock. Vern. *Batavi nimbu*, *maha nimbu*, *chakótra*, Hind.; *Kaljemi*, Nep.; *Lumbo*, Lepcha; *Shouktóno*, Burm.

A small tree. *Bark* thin, greyish-brown or greenish. *Wood* white or yellowish-white, hard, close-grained. *Pores* small, arranged

in wavy tangential white patches more prominently than in either of the other two species. *Medullary rays* fine, numerous.

Cultivated throughout India, having been originally introduced from Java.

		lbs.
O 4510.	Forest School Garden, Dehra Dún (Babu Birbal)	45

17. FERONIA, Correa.

1. **F. Elephantum,** Correa; Fl. Br. Ind. i. 516; Roxb. Fl. Ind. ii. 411; Bedd. Fl. Sylv. t. 121; Brandis For. Fl. 56; Kurz For. Fl. i. 198; Gamble Darj. List 15; Talbot Bomb. List 34; Trimen Fl. Ceyl. i. 228. The Wood-apple. Vern. *Bilin, kait, kat-bél,* Hind.; *Kath-bél,* Beng.; *Kabit,* Melghat; *Koito,* Uriya; *Cawtha,* Bombay; *Vallanga, vela, kavít,* Tel.; *Velagá, elaka, yellanga, vellam, vila, vilatti,* Tam.; *Bilwar,* Kan.; *Kawat,* Mar.; *Diwul,* Cingh.; *Thibin,* Burm.

A deciduous tree. *Bark* dark grey or nearly black. *Wood* yellowish- or greyish-white, hard. *Pores* small or moderate-sized, ringed, subdivided or in small patches, often filled with resin. *Medullary rays* short, white, prominent, moderately broad. *Annual rings* marked by a white line and the fewer pores of the autumn wood.

Dry open forests from the Ravi eastwards and southwards through Central India and the Deccan; Guzerat, the Konkan and Kanara; Prome District in Burma; dry region of Ceylon, where common.

Wood used, according to Brandis, for housebuilding, naves of wheels, oil-crushers and agricultural implements. Skinner, No. 74, gives W = 50 lbs., P = 645; Cunningham gives W = 49 lbs., P = 623; O'Connell (1886, Madras) gives W = 54, $a = 0{\cdot}00895$. It gives a gum similar to gum arabic. The pulp of the fruit is acid, and is made into jelly; the large grey fruit may be seen for sale in most Indian bazaars.

		lbs.
E 2487.	Royal Bot. Garden, Calcutta (King) .	—
D 4030.	Madras	45 (not a good specimen)
	Nordlinger's Sections, vol. 9.	

18. AEGLE, Correa.

1. **A. Marmelos,** Correa; Fl. Br. Ind. i. 516; Roxb. Fl. Ind. 579; Bedd. Fl. Sylv. t. 161; Brandis For. Fl. 57; Kurz For. Fl. i. 198; Gamble Darj. List 15; Talbot Bomb. List 34. The Bael tree. Vern. *Bél,* Hind.; *Bela,* Beng.; *Mahaka,* Gondi; *Bela,* Kurku; *Vilva, vilvam,* Tam.; *Maredu, patir, marat,* Tel.; *Bilapatri,* Kan.; *Baelo,* Uriya; *Belana,* Khond; *Marudu,* Palkonda; *Maika,* Gondi; *Lohagási,* Kól; *Singjo,* Sonthal; *Kuvalam,* Mal.; *Okshit,* Burm.

A small tree with thorny branches. *Bark* ½ in. thick, outer substance soft, grey, exfoliating in irregular flakes. *Wood* yellowish-white or greyish-white, hard, with a strong aromatic scent when fresh cut; no heartwood. *Pores* small, ringed, in small groups of 2 or 3 together, sometimes, but not always, more numerous in the autumn wood. *Medullary rays* wavy, fine, short, white, numerous, uniform and equidistant. *Annual rings* marked by distinct lines, and often by a continuous belt of pores.

Sub-Himalayan forests from the Jhelum eastwards; Central and South India, scarce in Western India; Burma. Always in the dry forests. Often cultivated.

Weight 40 to 50 (Brandis); Wallich gives 49 lbs.; specimens examined average 56 lbs. An analysis of the ash showed that out of 2·65 lbs. of ash in 100 lbs. of steam-dry wood 2·16 lbs. consisted of calcium carbonate.

The tree is not often cut, as it is chiefly valued for its fruit, the pulp of which is used medicinally in diarrhœa and dysentery, as a sherbet and as a conserve, keeping

well when dry. The wood is used in construction, for the pestles of oil and sugar-mills, naves and other parts of carts, and for agricultural implements (Brandis).

The young leaves and shoots are eaten by the caterpillar of the butterfly, *Papilio erithonius*, Cramer. The leaves are used in Sivaite religious ceremonies, and the wood is used for sacrificial fires (U. N. Kanjilal).

		lbs.
P 441.	Ajmere	—
O 248, 268.	Garhwal (1868)	57 and 60
C 1176.	Ahiri Reserve, Central Provinces (R. Thompson)	52
C 2785.	Melghát, Berar (Brandis)	62
C 3790.	Surada Forests, Ganjam (Gamble)	51
E 2486.	Royal Bot. Garden, Calcutta (King)	—
E 638.	Goalpara, Assam (Mann)	53
B 564.	Prome, Burma (Ribbentrop)	60
	Nordlinger's Sections, vol. 9 (Tab. II. 5).	

ORDER XXVI. SIMARUBEÆ.

A small Order, containing eight Indian genera, trees or shrubs, almost always with bitter bark, and often with bitter wood. Quassia wood is the produce of *Quassia amara*, L. and *Picræna excelsa*, Ldl., trees of the West Indies. The Lignum-vitæ wood is given by *Guaiacum officianale*, L., occasionally cultivated, as in Calcutta and Madras.

The genera belong to two Tribes, viz.—

Tribe I. Simarubeæ . . . Ailanthus, Samadera, Picrasma, Brucea, Eurycoma, Suriana.

„ II. Picramnieæ . . . Harrisonia, Balanites.

Wood white or yellow, soft. *Pores* moderate-sized. *Medullary rays* moderately broad to broad. That of *Balanites* is anomalous.

1. AILANTHUS, Desf.

Besides the two species described, a third, *A. grandis*, Prain in Ind. For. xxviii. 131; Vern. *Gogul*, Nep., has just been discovered in Assam and the Darjeeling Hills. It is a very large tree, 120 ft. in height. *A. glandulosa*, Desf., is a lofty tree, indigenous in Japan, but occasionally planted both in Europe and in Northern India. It grows rapidly, throwing up abundant root-suckers, and has for that reason been employed in plantations made to clothe barren stony hills in the south of France. It is also often employed as an avenue tree, and is cultivated in gardens.

Wood white, soft. *Annual rings* marked by rows of large pores. *Pores* in the spring wood large; in the rest, small or moderate-sized, scanty. *Medullary rays* few, moderately broad.

1. **A. excelsa,** Roxb. Fl. Ind. ii. 450; Fl. Br. Ind. i. 518; Bedd. Fl. Sylv. xlix.; Brandis For. Fl. 58; Talbot Bomb. List 35. Vern. *Arúa*, Meywar; *Maha rukh*, Hind., Mar.; *Márup, marukh*, Berar; *Peru, pee*, Tam.; *Pedu, pey, pedda, pedda manu*, Tel.; *Gormi-kawat, mahanim*, Uriya; *Ghor-karam*, Palamow; *Peddamandu*, Palkonda.

A large tree. *Bark* light greyish-brown, fibrous or granular, rough. *Wood* white, soft. *Pores* large, scanty, subdivided, ringed. *Medullary rays* broad, numerous, close, the distance between them less than the transverse diameter of the pores.

From the Ganges southwards, Chota Nagpore, C.P., N. Circars, Khandésh, Guzerat, Deccan and Carnatic. Often planted, and very easy of cultivation.

The light wood is used for fishing-floats, catamarans (rough raft-like boats used on the Coromandel coast), sword-handles, spear-sheaths. Weight about 25 lbs. per cubic foot. The bark is used as a febrifuge and tonic.

		lbs.
C 2784.	Melghát, Berar (Brandis)	—
C 3449.	Betlah Forest, Palamow (Gamble)	—
C 3941.	Ganjam Forests (Gamble)	23
C 4464.	Chanda, C.P. (Lowrie)	—
No. 4, Salem Collection		28

2. **A. malabarica,** DC; Fl. Br. Ind. i. 518; Bedd. Fl. Sylv. t. 122; Brandis For. Fl. 58; Kurz For. Fl. i. 200; Talbot Bomb. List 35; Trimen Fl. Ceyl. i. 230. Vern. *Peru*, Tam., Tel.; *Dhúp, baga-dhúp, gogul-dhúp*, Kan.; *Matti pál*, Anamalais; *Thuma*, Trav. Hills; *Kambalu, walbiling*, Cingh.

A large deciduous tree. *Bark* thick, rough. *Wood* white, very soft and spongy. *Pores* large, scanty, subdivided. *Medullary rays* short, moderately broad, the distance between the rays being greater than the transverse diameter of the pores.

Forests of the Western Ghâts up to 5000 ft.; Burma, rare in Pegu. Often planted in South India for ornament.

A fine ornamental tree. The wood is not used. The tree gives a gum resin which is used medicinally, especially in dysentery. For Mr. Broughton's report on an analysis of it, see Beddome, t. 122.

		lbs.
W 746.	South Kanara (Cherry)	23

2. SAMADERA, Gaertn.

1. **S. indica,** Gaertn.; Fl. Br. Ind. i. 519; Bedd. Fl. Sylv. xlix.; Kurz For. Fl. i. 200; Talbot Bomb. List 35; Trimen Fl. Ceyl. i. 231; Vern. *Samadara*, Cingh.; *Karingotta*, Mal.; *Kathè*, Burm.

A small tree. *Bark* pale, transversely cracked. *Wood* light yellow, soft, no heartwood. *Pores* small, very scanty. *Medullary rays* very fine, uniform, closely packed.

South India and Ceylon; usually on the coast in salt or brackish water-channels.

An interesting tree, whose bark is used as a febrifuge. The wood also is bitter, like Quassia. On the Travancore-Cochin coast it is much used for making clogs. The seeds give an oil, used for lighting.

		lbs.
W 3907.	Cochin (Gamble)	27
No. 76, Ceylon Collection, old; No. 122, new (Mendis)		26

3. PICRASMA, Bl.

Three species are described in the Fl. Br. Ind., and Kurz adds another, which, however, though he gives no synonyms, must include one of those of the Fl. Br. Ind. King, however, has set matters right in his "Materials for a Flora of the Mal. Penins." (*Journ. As. Soc. Beng.* lxii. ii. 228), where he explains that *P. nepalensis*, Benn. and *P. andamanica*, Kurz are both referable to *P. javanica*, Bl.

1. **P. quassioides,** Benn.; Fl. Br. Ind. i. 520; Brandis For. Fl. 59. Vern. *Tuthai, tithu, hala*, Pb.; *Charangi*, Hind.; *Karúi*, Jaunsar.

A small tree. *Bark* light brown, rather smooth, shining, thin. *Wood* bright yellow, moderately hard, sapwood white. *Annual rings* well marked by a line of pores in the autumn wood. *Pores* moderate-sized, unevenly scattered except on the line of the annual rings. *Medullary rays* fine to moderately broad, short, distant, forming on a radial section a pretty silver-grain.

Forests of the higher hills of the West Himalaya from the Chenab to Nepal, in ravines under forest of deodar, oak, firs, etc., at 6–8000 ft.

The bark and wood are bitter, and are used in native medicine as a tonic; the growth is slow, 16 rings per inch of radius.

		lbs.
H. 4413.	Deota, Tehri-Garhwal, 7500 ft. (Gamble)	32

2. P. javanica, Bl.; Fl. Br. Ind. i. 520; Kurz For. Fl. i. 201. *P. nepalensis*, Benn.; Fl. Br. Ind. i. 520; Gamble Darj. List 15. *P. andamanica*, Kurz; Fl. Br. Ind. i. 520. Vern. *Tungchir*, Lepcha; *Thityu*, Burm.

An evergreen tree. *Wood* white or yellowish-white, soft. *Pores* small, uniformly distributed, joined by fine concentric lines. *Medullary rays* short, fine.

East Himalaya at about 5000 ft.; Khasia Hills; forests of Martaban and Tenasserim; Andaman Islands.

		lbs.
B 1977.	Andamans (Kurz, 1866)	27

4. BRUCEA, Mill. Two bitter shrubs. *B. sumatrana*, Roxb. Fl. Ind. i. 449; Fl. Br. Ind. i. 521; Kurz For. Fl. i. 202, is a large evergreen shrub of Assam, Tenasserim and the Andaman Islands. *B. mollis*, Wall.; Fl. Br. Ind. i. 521; Kurz For. Fl. i. 202; Gamble Darj. List 15, is a shrub of the North-East Himalaya and Sylhet, ascending to 6000 ft.; also of the Kachin Hills, the Karen Hills and the mountains of Tenasserim in Burma.

5. EURYCOMA, Jack.

1. E. longifolia, Jack; Fl. Br. Ind. i. 521; Kurz For. Fl. i. 202.

A small tree. *Bark* thin, greyish-brown, peeling off in small flakes and with very narrow fine horizontal markings. *Wood* greyish-white, soft to moderately hard. *Pores* moderate-sized, scanty, resinous. *Medullary rays* fine, distinct, numerous, stopping at the pores.

Tenasserim and the Andaman Islands.
The bark is bitter, and is used in the Malay Archipelago as a febrifuge.

Straits Settlements: Col. and Ind. Exhibition, 1886—Kew Museum.
" —Kew Museum (Ridley).

6. SURIANA, Linn. *S. maritima*, Linn.; Fl. Br. Ind. i. 522; Trimen Fl. Ceyl. i. 232, is a sea-coast shrub with thick velvety branches and yellow flowers. It is apparently scarce, as Kurz does not mention it, and Trimen says it has only been found in Ceylon at Jaffna and Trincomalee. It is found in the Laccadive Islands.

7. HARRISONIA, Brown.

1. H. Bennettii, Hook. f.; Fl. Br. Ind. i. 519; Kurz For. Fl. i. 203. Vern. *Tabu*, Burm.

A small thorny, deciduous tree, the stem armed with small spines on large corky excrescences, as in *Toddalia* and *Pterolobium*. *Bark* thin, greyish-white, with many small circular or oblong lenticels when young; when older brown with rounded bosses. *Wood* moderately hard, sapwood white, heartwood brown streaked with black. *Annual rings* marked by a pale line. *Pores* moderate-sized, often subdivided into two or three, evenly distributed, numerous. *Medullary rays* fine, regular. *Pith* large.

Dry forests of Upper Burma, the Prome District and Martaban.

		lbs.
B 4855.	Yabé Reserve, Magwe, Burma (S. E. Jenkins)	—
B 4874.	Myittha, Burma	58
B 5000.	Minbu, Burma (Calthrop)	56

8. BALANITES, Delile.

1. **B. Roxburghii**, Planch.; Fl. Br. Ind. i. 522; Brandis For. Fl. 59; Kurz For. Fl. i. 204. *B. ægyptiaca*, Delile; Bedd. Fl. Sylv. l. *Ximenia ægyptiaca*, Roxb. Fl. Ind. ii. 253. Vern. *Hingu, ingua, hingol, hingota*, Hind.; *Garrah*, Gondi; *Gari, ringri*, Tel.; *Nanjunda*, Tam.; *Hingan, hingu*, Mar.

A small tree. *Bark* grey, ¼ in. thick. *Wood* yellowish-white, moderately hard, no heartwood, no annual rings. *Pores* small or moderate-sized, scanty, distributed in irregular bands and groups.* *Medullary rays* short, moderately broad; on a radial section visible as narrow plates, the pores being also well marked as wavy lines on that section.

Drier parts of India and Burma.

This tree is characteristic of black cotton soils, but is found on other dry soils also. It is readily recognized by its ashy-green foliage. The wood is used for walking-sticks and for fuel. From the seed a fixed oil is expressed. The seeds, bark and leaves are used in native medicine, and the kernel of the fruit, filled with gunpowder, in fireworks. The pulp of the fruit is used to clean silk in Rajputana (Duthie).

		lbs.
P 450.	Ajmere	48
C 1171.	Ahiri Reserve, Central Provinces (R. Thompson)	—
C 4466.	Chanda District, C. P. (Lowrie)	—
D 4205.	Kistna District (Gamble)	48

Nordlinger's Sections, vol. 6 (*B. ægyptiaca*) (Tab. II. 6).

ORDER XXVII. OCHNACEÆ.

Two genera, Ochna and Gomphia, all trees or shrubs with simple leaves and bright yellow conspicuous flowers.

1. OCHNA, Linn.

Seven or eight species. *O. Wightiana*, Wall.; Fl. Br. Ind. i. 524; Bedd. Fl. Sylv. li.; Trimen Fl. Ceyl. i. 233; Vern. *Kat-karai*, Tam.; *Bo-kera*, Cingh., is a tree of evergreen forests in Travancore and the low country in Ceylon, with, according to Trimen, a light, soft, pale yellow wood. *O. fruticulosa*, Kurz For. Fl. 206, is a stunted dwarf shrub of Eng-deing and other open forests in Burma; while *O. pumila*, Ham. is a small dwarf shrub of the sub-Himalayan tract, principally in Sál forests and especially common in the Darjeeling Terai and Western Dúars, where, in places commonly overrun by jungle fires, the thick rootstock sends up annual stems with large bright yellow conspicuous flowers. *O. rufescens*, Thw.; Trimen Fl. Ceyl. i. 234, is a small endemic tree or shrub of Ceylon.

Wood reddish-brown, even-grained. *Pores* small, uniformly distributed. *Medullary rays* not prominent, moderately broad, short, giving a pretty silver-grain.

* The arrangement of these groups, which contain from two to twelve or more pores of all sizes, is very interesting if only on account of their irregularity. Sometimes, too, they are between the medullary rays, sometimes the medullary rays pass through them, and again sometimes they stop, and may begin again or not afterwards. The cellular tissue also is curious; sometimes it is loose, and the cells are large; sometimes the cells are very small and the texture thick, but the patches of either texture make more or less concentric zigzag bands. The plate is probably from an African specimen, but the wood of the Indian tree is the same.

1. O. squarrosa, Linn.; Fl. Br. Ind. i. 523; Roxb. Fl. Ind. ii. 643; Bedd. Fl. Sylv. l.; Brandis For. Fl. 60; Kurz For. Fl. i. 205; Talbot Bomb. List 36; Trimen Fl. Ceyl. i. 233. Vern. *Sunari, yerra-júvi,* Tel.; *Chilanti,* Tam.; *Narole, mudah,* Kan.; *Koniári, nobunisero,* Uriya; *Mal-kera,* Cingh.

A small tree. *Bark* brown, thin, smooth. *Wood* reddish-brown, moderately hard, close-grained. *Pores* very small, numerous, regular, in the spaces between the moderately broad but not prominent *medullary rays,* which give a pretty silver-grain.

Dry forests of Central and Southern India: on the east, especially common in Orissa, the Circars and Ceded Districts; on the west, in the forests of the Konkan and Kanara, both near the sea and inland up to 2000 ft., more scarce to the south; Shan Hills and Prome Hills in Burma; dry country of Ceylon.

The wood is worthy of attention for inlaying and carving, but requires careful seasoning, as it warps badly. It is used for walking-sticks. Weight about 50 lbs. per cubic foot.

	lbs.
C 1305. Gumsúr Forests, Ganjam (Dampier)	51
C 3541, 3639. Khurdha Forests, Orissa (Gamble)	46
C 3781. Kurcholy Forests, Ganjam (Gamble)	51

Var. *glauca.* *O. Gamblei,* King MS. in Herb. Calc. Vern. *Kuku-moi, kuka-mogi,* Tel.

Wood like that of *O. squarrosa,* but *bark* thicker, *pores* larger, and there are bands of darker wood at intervals which show well on a tangential section.

This is a small tree, very common in places, especially on the hills of Cuddapah and on Kambakam hill in Chingleput. It has very glaucous, nearly sessile leaves, tufted at the ends of much thicker branches, and small almost umbellate panicles on the old wood. But the flowers resemble those of *O. squarrosa.* It may prove to be a separate species, as I have always thought it to be. It likes drier localities and more rocky sites than does *O. squarrosa.*

	lbs.
D 3799. Horsleykonda, Cuddapah, 4000 ft. (Gamble)	50

2. O. Wallichii, Planch; Fl. Br. Ind. i. 524 (part); Kurz For. Fl. i. 205. Vern. *Yodaya,* Burm.

A deciduous tree. *Wood* reddish-brown, hard, close-grained. *Pores* small, rather scanty, between the fine to moderately broad *medullary rays.* A pretty silver-grain.

Tropical forests of Martaban and Tenasserim; less common in the Pegu Yoma.

	lbs.
B 3132. Burma (Brandis, 1862)	54

3. O. andamanica, Kurz For. Fl. i. 205.

A small deciduous tree. *Wood* red, hard, similar in structure to that of *O. squarrosa.*

Tropical and moister upper mixed forests of the Andamans.

	lbs.
B 1978. Andaman Islands (Kurz 1866)	58

No. 13, Ceylon Collection, new (Mendis), called "*Bokela*"—*Sandoricum,* is probably an *Ochna,* perhaps *O. Wightiana,* but Trimen says that both species have a "pale yellow" wood, while No. 13 is reddish-brown, with the structure of *O. squarrosa.*

2. GOMPHIA, Schreb.

Two species. *G. sumatrana,* Jack; Fl. Br. Ind. i. 525; Kurz For. Fl. i. 206, is a small tree of the sea-coast of Tenasserim.

1. **G. angustifolia,** Vahl; Fl. Br. Ind. i. 525; Bedd. Fl. Sylv. li.; Trimen Fl. Ceyl. i. 235. Vern. *Bo-kera*, Cingh.

A small branching tree. *Wood* reddish-brown, hard, close- and even-grained, cuts easily. *Pores* very small, very numerous, regularly distributed. *Medullary rays* fine to moderately broad, very numerous, regular.

Evergreen forests of the Western Gháts and Coast; low country of Ceylon.

Ceylon—Int. Exhn., 1862 (Kew Museum).

ORDER XXVIII. BURSERACEÆ.

Six genera, mostly trees, some of them of large size, a few important for timber, others important in forest economy. They are mostly resinous, and the Order contains the trees which give the fragrant resins myrrh and frankincense.

Genera: Boswellia, Garuga, Balsamodendron, Bursera, Canarium, Filicium.

In accordance with Trimen's opinion, I have placed *Protium* under *Balsamodendron*; but I have not followed Engler (DC Monog. Phan. iv.) in transferring both *Balsamodendron* and *Protium*, W. and A. to *Commiphora*, Jacq. and *Bursera* to *Protium*, Burm. To make such a change might be confusing, but it apparently has been accepted in the "Index Kewensis."

Wood soft or moderately hard (*Filicium* very hard). *Pores* small or moderate-sized, uniformly distributed. *Medullary rays* fine, distant.

1. BOSWELLIA, Roxb.

1. **B. serrata,** Roxb. ex Colebr. in As. Res. ix. 379; Fl. Br. Ind. i. 528; Talbot Bomb. List 36. *B. thurifera*, Roxb. Fl. Ind. ii. 383; Brandis For. Fl. 61, 573; Bedd. Fl. Sylv. lii. *B. glabra*, Roxb. Fl. Ind. ii. 384; Bedd. Fl. Sylv. t. 124. Vern. *Salhe, salai, sálgá*, Hind.; *Guggar, salaia guggar*, Kumaon; *Salla, bor-salai, ganga*, Gondi; *Luban, salai*, Beng.; *Kungli, gúgúlu, kúndrikam, morada*, Tam.; *Anduku, anduga, parangi*, Tel.; *Salai, salphullia*, Mar.; *Chitta*, Kan.; *Sálgá*, Sonthal; *Saler*, Jeypore.

A deciduous tree, often large, sometimes only moderate-sized, often gregarious. *Bark* ½ in. thick, yellow or greenish-yellow, exfoliating in small hard irregular flakes or thin plates. *Wood* moderately hard, smooth: sapwood white; heartwood brown (dark greenish-brown, cf. Ind. For. vi. 328), sometimes very small, so that the wood has been described as white, but when present rather handsome, often streaked in darker and lighter bands. *Pores* scanty, moderate-sized, often subdivided, often containing resin. *Medullary rays* moderately broad, very short, not very numerous.

Common on dry hills throughout India; commencing from the Sutlej, it follows the southern slopes of the Siwaliks of Umballa and Saharanpur and the lower hills eastwards to Nepal. It is common throughout the deciduous forests of Rajputana, Behar, the C.P., Khandésh, Orissa, the Circars, Deccan and Carnatic, preferring the driest, hottest exposures and rocky hills, especially trap. Not in Assam, Burma or Ceylon.

This is an important forest tree, for it grows where others of greater commercial value refuse to thrive, and often forms considerable forests to itself alone, reproducing freely both by seed and in coppice. Its timber has been, rather unjustly, considered of poor quality, but I have seen some pieces of it, and especially a piece cut by Mr. A. F. Gradon in the Saharanpur Siwaliks, which were quite handsome (see also "An 'apology for Salai"—Ind. For. vi. 328). Good pieces of the wood are fairly durable and not much liable to the attacks of white ants. It has been tried for sleepers, but the results were probably not very good. It is a good fuel, but burns quickly in small

pieces, slowly and with much smoke in big. The weight of the wood varies from 28 lbs. to 42 lbs. per cubic foot according to quality; Brandis gives 30 to 35 lbs. It gives a quantity of a green gum-resin from wounds in the bark; and this, which is a kind of frankincense, has an agreeable scent when burnt, and is used for incense (*Labanu*), but it is not, as H. T. Colebrooke (As. Res. ix. 377, 1807) and T. Fleming (As. Res. xi. 158, 1810) have supposed, the real frankincense, which is given by various species of *Boswellia* growing in Arabia and Somaliland (Birdwood in *Trans. Linn. Soc.* xxvii. 111). The gum is also used medicinally as a diaphoretic and astringent and to make ointment for sores. The foliage is said to be used as cattle fodder in Merwara (Duthie), but this may be a mistake.

Fernandez (Man. Ind. Sylv. 99) says that the Salai forms pure forest where the amount of iron in the soil becomes marked, as it is in places on the dry trap and sandstone hills of Central India. He specially remarks on its capability of withstanding the effects of forest fires; its immunity from being browsed or lopped for fodder on account of its too resinous leaves; its power of withstanding insolation and drought and its preference for localities where frosts are not serious; and its great powers of reproduction by seed, by coppice and by suckers. It is, consequently, a valuable tree in the process of reclothing dry hills where vegetation is poor and complete protection against overcutting, grazing and fire is not always feasible.

		lbs.
P 3215.	Nagpahar, Ajmere	—
O 4828.	Saharanpur Siwaliks (Gradon)	42
C 1112.	Ahiri Forest, C.P. (R. Thompson)	36
C 2780.	Melghát Forest, Berar (Brandis)	28 (sapw.)
C 3680.	Palamow, Chota Nagpore (Gamble)	28 (sapw.)
D 4140.	Sandur Forests, Bellary ,,	49 (wet)
	Nordlinger's Sections, vol 8 (Tab. III. 1).	

2. GARUGA, Roxb.

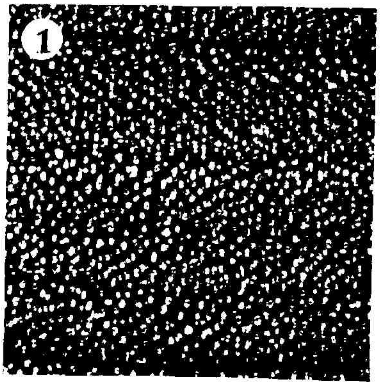
1. G. pinnata, Roxb. Fl. Ind. ii. 400; Fl. Br. Ind. i. 528; Bedd. Fl. Sylv. t. 118; Brandis For. Fl. 62, t. 13; Kurz For. Fl. i. 207; Gamble Darj. List 16; Talbot Bomb. List 36. Vern. *Khárpat, katúla, kilmira, sarota*, Pb.; *Ghogar, kaikar*, Hind.; *Tilmadi, kanman*, Kumaon; *Gurja*, Banda; *Kaikar, kaikra, ghunja, mahárut*, C.P.; *Júm, kharpat, nil bhadi*, Beng.; *Mohi, sompotri*, Uriya; *Gia*, Mechi; *Dabdabbi*, Nep.; *Maldit, róm*, Lepcha; *Gendeli poma*, Ass.; *Chitompa*, Gáro; *Mroung-shisha*, Magh; *Garuga, gárgá*, Tel.; *Gúpni, gharri, kekra*, Gondi; *Karúr*, Sonthal, Bhumij; *Kékur*, Kharwar; *Nia jowa*, Kól; *Kosomara*, Ghatwal; *Kosromba*, Mal Pahari; *Sompotri dopé*, Khond; *Kahúd, kekda*, Berar; *Kekkeda*, Kurku; *Karre vembu*, Tam.; *Kuruk, kudak, kangkur, kakad*, Mar.; *Halabalagi*, Kan.; *Chinyôk*, Burm.

A large deciduous tree. *Bark* 1 in. thick, soft, red inside, grey or brown outside, exfoliating in large irregularly shaped scales. *Wood* variable: sapwood white, large; heartwood reddish-brown, moderately hard, even-grained. *Pores* large, not numerous, often subdivided, sometimes filled with resin. *Medullary rays* short, moderately broad; on a radial section visible as narrow horizontal plates, and giving a pretty silver-grain.

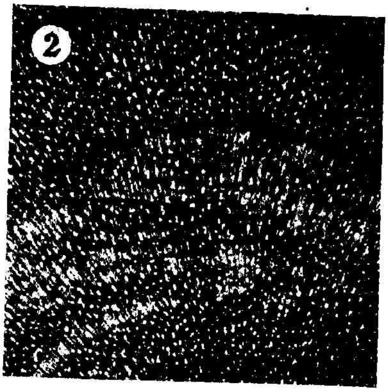
Very widely distributed in forests almost throughout India; found from the Umballa Siwalik hills eastwards, and in the lower hills and valleys of the Himalaya up to over 3000 ft., to Assam; throughout Central, Western and Southern India, usually in deciduous forests; mixed forests all over Burma; the Andaman and Cocos Islands.

This is another tree of not very great timber value, but of considerable forest importance as an associate with Teak and Sál, and as a useful kind on account of its power of seed and coppice reproduction. Its wood, too, like that of *Boswellia*, has been much undervalued, for when grown into a big tree it gives a rather handsome reddish-brown heartwood of good quality quite fit for furniture. But it is most usually found as a comparatively small tree with little or no heartwood, and then the wood is of poor quality, not durable and naturally rejected. It is a bad fuel. The weight of the wood,

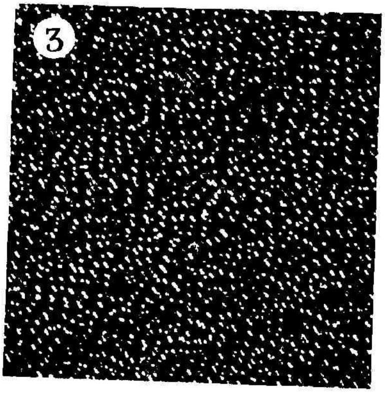
III.



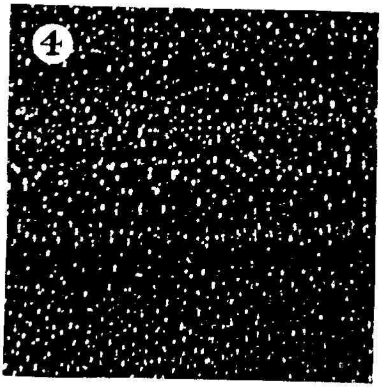
BOSWELLIA SERRATA.



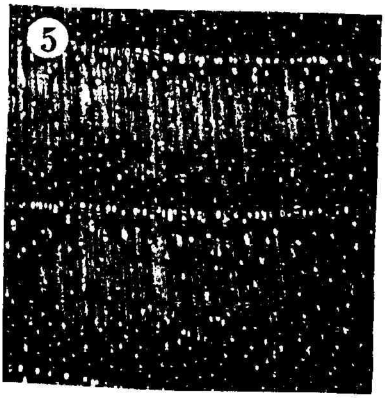
MELIA INDICA.



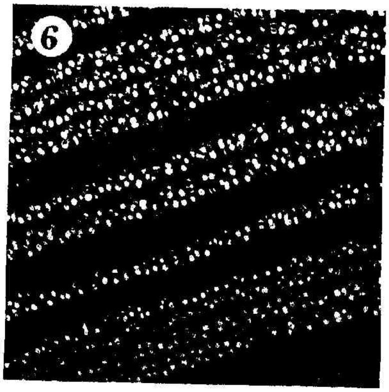
DYSOXYLUM HAMILTONII.



SWIETENIA MAHAGONI.



CEDRELA TOONA.



CEDRELA SERRATA.

(*Magnified* 3½ *times.*)

according to Brandis, No. 45, is 52 lbs. per cubic foot; the specimens examined vary from 31 to 46 lbs., 40 lbs. being probably about right. It is probably Wallich's *Jeeah*, 36 lbs. The bark is used for tanning, and the leaves for fodder. It gives a copious clear gum of no value. The fruit is sometimes eaten. It grows readily from cuttings. The leaves have very often on their petioles oval, smooth, round galls which are caused by a Hemipterous insect, *Phacopteron lentiginosum*, Buckton.

		lbs.
O 225.	Garhwal (1868)	39
O 346.	Gorakhpúr (1868)	39
C 1107.	Chanda, C.P. (R. Thompson)	39
E 648.	Darjeeling Terai (Manson)	39
E 3604.	Sukna Forest, Darjeeling Terai (Gamble)	40
E 3677.	Darjeeling Terai (Gamble)	31
E 1389.	Chittagong (Chester)	46
B 812.	Burma (Ribbentrop)	39
	Nordlinger's Sections, Vol. 9.	

3. BALSAMODENDRON, Kunth.

Contains five species of balsamiferous, often spiny, shrubs or trees. Besides the two described below, it contains *B. pubescens*, Stocks; Fl. Br. Ind. i. 529; Brandis For. Fl. 65; Talbot Bomb. List 67; Vern. *Bayi, bai*, Baluch., a small tree of Baluchistan and the hills between that country and Sind, as far south as Karachi. It yields a small quantity of tasteless, inodorous, brittle gum, almost entirely soluble in water. *B. Berryi*, Arnott; Fl. Br. Ind. 529; Brandis For. Fl. 65; Bedd. Fl. Sylv. t. 126; Talbot Bomb. List 37, is a tree of Coimbatore, very largely cultivated as a hedge plant. It is very fragrant, and gives a gum-resin. *B. Roxburghii*, Arn.; Fl. Br. Ind. i. 529; Vern. *Gugala*, Beng., is a small tree of Eastern Bengal and Assam. The drug called "Myrrh" is the gum-resinous exudation of *B. Myrrha*, Ehrenb., a small tree of Arabia and the African coast of the Red Sea.

1. **B. Mukul**, Hook.; Fl. Br. Ind. i. 529; Brandis For. Fl. 64; Talbot Bomb. List 37. Vern. *Gúgal*, Sindi, Jeypore, Berar.

A small tree. *Bark* greenish-yellow, peeling off in long thin, shining, paper-like scrolls. *Wood* soft, white. *Pores* small. *Medullary rays* fine, short.

Abundant on rocky ground in the arid zone, in Baluchistan, Sind, Kattywar, Rajputana and Khandésh.

An important tree on account of its growth in localities where other and better species do not thrive. The wood is not used. The tree yields a gum called "Gugal" or Indian Bdellium, which is obtained from incisions made in the bark, and is used in native medicine and for preparing an ointment for bad ulcers.

		lbs.
P 448.	Ajmere	—
P 2919.	Rajputana (Brandis)	20
P 3238.	Dewair, Ajmere	—

2. **B. caudatum**, March.; Trimen Fl. Ceyl. i. 236. *Protium caudatum*, W. and A.; Fl. Br. Ind. i. 530; Bedd. Fl. Sylv. t. 125. Vern. *Konda mamidi*, Tel.; *Konda mavu*, Kan.; *Kilevay, niluve*, Tam.

A deciduous tree. *Bark* green, turning brown and peeling off in thin papery flakes, $\frac{1}{8}$ in. thick. *Wood:* sapwood white, heartwood grey with darker streaks, cuts smoothly. *Pores* few, small, scanty. *Medullary rays* moderately hard, numerous, whitish.

Forests of dry hills in the Deccan and Carnatic and the drier parts of the West Coast.

The tree is occasionally used as an avenue tree, and is often planted, as it grows so easily from cuttings. The leaves and bark have the resinous smell of mangoes.

		lbs.
D 4311.	Kodur, Cuddapah (Gamble)	33

4. BURSERA, Linn.

1. **B. serrata,** Colebr.; Fl. Br. Ind. i. 530; Brandis For. Fl. 61; Kurz For. Fl. i. 208. *Limonia pentagyna*, Roxb. Fl. Ind. ii. 382. Vern. *Murtenga*, Ass.; *Sorupotri moi*, Uriya; *Urmú*, Sonthal; *Sari*, Mal Pahari; *Saradi*, Khond; *Chitreka*, Tel.; *Thadi*, Burm.

A large evergreen tree. *Wood* hard, sapwood light brown, heartwood red, close-grained. *Pores* small, uniformly distributed. *Medullary rays* fine, red, making a good silver-grain.

Forests of the Gáro Hills and Chittagong; Rajmehal Hills, Sonthal Parganas, Chota Nagpore and Northern Circars down to the Godavari, usually along streams. Very common in the Saranda Forests, in Ganjam and Rumpa. In Burma, along streams in tropical forests of Pegu and Martaban, extending north to Myitkyina.

It is strange that Beddome makes no mention of this common Circar tree, so common in valleys and along watercourses. It gives a useful wood, said by Kurz to be good for furniture.

		lbs.
B 313.	Burma (1867)	46
B 2225.	Andamans (doubtful, but structure similar)	37

5. CANARIUM, Linn.

About nine species, all large trees of a resinous character. Three of them are only known from the Andaman Islands, two from Ceylon, two from Assam, one from Sikkim, and one, a very conspicuous common tree, from S. India. *C. reziniferum*, Brace; King in Journ. As. Soc. Beng. lxii. ii. 188; Vern. *Dhúna, dhua*, Ass., is also a large tree of Assam and the Khasia Hills, giving a resin which is used for torches. *C. euphyllum*, Kurz, *C. coccineo-bracteatum*, Kurz, and *C. Manii*, King, are large trees of the Andaman Islands.

1. **C. sikkimense,** King in Journ. As. Soc. Beng. lxii. ii. 187; Gamble Darj. List 16. Vern. *Goguldhup*, Nep.; *Narockpa*, Lepcha.

A tall tree with straight cylindrical stem. *Bark* light coloured, hard, thin, rough with horizontal wrinkles. *Wood* shining, white when fresh cut, turning grey on exposure, soft, even-grained, does not warp, but decays readily. *Pores* scanty, large, often oval and subdivided, prominent on a vertical section. *Medullary rays* fine, the silver-grain conspicuous.

Sikkim, in tropical valleys at 1–3000 ft.

This is a beautiful tall tree, with clean grey bole, very straight and cylindrical; it was formerly very common, but is now scarce, perhaps because the wood has been largely used for tea-boxes and shingles. It yields a clear amber-coloured brittle resin, used for incense.

		lbs.
E 703.	Great Rangit Valley, Darjeeling, 3500 ft. (Manson) . . .	28
E 3592.	Sukua Forest, Darjeeling (Gamble).	—

2. **C. bengalense,** Roxb. Fl. Ind. iii. 136; Fl. Br. Ind. i. 534; Kurz For. Fl. i. 209. Vern. *Neribi*, Ass.

A tall evergreen tree. *Bark* ½ in. thick, rather smooth, greyish-white, with numerous lenticels, peeling off in small round thick flakes. *Wood* soft, sapwood yellowish-white, heartwood reddish-brown. *Pores* large, scanty, often subdivided, prominent on a vertical section. *Medullary rays* fine, not numerous, giving a satiny silver-grain.

Assam, Sylhet and mixed forests of the Pegu Yoma.

A fine tree, not very well known, but the wood seems good. It clearly does not warp, and looks suitable for planking for tea-boxes and other purposes. The tree gives a clear brittle amber-coloured resin which resembles copal, but is apparently not used (Roxb.).

		lbs.
E 4886.	Assam (Babu Tara Kisor Gupta)	39

3. C. strictum, Roxb. Fl. Ind. iii. 138; Fl. Br. Ind. i. 534; Bedd. Fl. Sylv. t. 128; Talbot Bomb. List 37. The Black Dammar tree. Vern. *Karapu kongiliam, karang kunthrikam,* Tam.; *Manda dhúp, raldhúp,* Kan.; *Thelli,* Mal.

A very large deciduous tree. *Bark* grey, roughish. *Wood* moderately hard, heartwood pink, sapwood greyish-white. *Pores* moderate-sized, scanty, often subdivided. *Medullary rays* fine, numerous.

Evergreen forests of the West Coast up to about 5000 ft.

This handsome tree is one of the most conspicuous trees in the forests of the Western Gháts, especially when coming into new leaf, for the young leaves are of a bright crimson colour, very hairy, and like red velvet. The timber is little used, but the resin, which is "obtained by the barbarous and destructive method of cutting 'gashes in the lower part of the stem and then setting it on fire" (G. King), is a considerable article of trade. For Mr. Broughton's analysis of this resin, see Beddome under t. 128. Bourdillon's experiment of 1896 gave for the wood: W = 35, P = 523.

		lbs.
W 4533, 4614.	Travancore (Bourdillon)	44 and 32

4. C. zeylanicum, Bl.; Fl. Br. Ind. i. 532; Bedd. Fl. Sylv. lii.; Trimen Fl. Ceyl. i. 239. Vern. *Pakkilipal,* Tam.; *Kékuna,* Cingh.

A large resinous tree. *Bark* thin, pale, smooth. *Wood* light greyish-brown, soft. *Pores* small, evenly distributed. *Medullary rays* moderately broad.

Low country in the moist region of Ceylon.

The whole tree is fragrant, and gives a clear gum-resin, used to burn for fumigation and for light. The oily seeds are eaten. Weight 28 lbs. per cubic foot. The wood is used for packing-cases and coffins (Mendis).

No. 69. Ceylon Collection, new (Mendis).

5. C. brunneum, Bedd. Fl. Sylv. t. 127; Fl. Br. Ind. i. 531; Trimen Fl. Ceyl. i. 238, t. 23. Vern. *Maha-bulumora,* Cingh.

A large resinous tree with buttressed trunk. *Bark* rough, blackish. *Wood* soft, sapwood grey, heartwood light red. *Pores* moderate-sized, often transversely barred, scanty. *Medullary rays* fine, not numerous, inconspicuous.

Upper zone of moist low country in Ceylon.

Trimen says the pulp of the fruit is pleasant, but rather bitter, the seeds being very bitter.

Ceylon, Int. Exhn., 1862—Kew Museum.

6. C. commune, Linn.; Fl. Br. Ind. i. 531; Trimen Fl. Ceyl. i. 240. The Java Almond. Vern. *Rata-kékuna,* Cingh.

A very large tree. *Wood* greyish-white, soft, smooth. *Pores* moderate-sized, scanty. *Medullary rays* brown, moderate-sized, not numerous.

A Malay tree, introduced into and cultivated occasionally in India and Ceylon. The seeds are eaten as a substitute for almonds.

		lbs.
D 4134.	Agri-Horticultural Gardens, Madras (Steavenson) . . .	37

6. FILICIUM, Thwaites.

1. F. decipiens, Thw.; Fl. Br. Ind. i. 539; Bedd. Fl. Sylv. t. 129; Trimen Fl Ceyl. i. 240. Vern. *Katu puveras, athalanghi,* Tam.; *Val murichha, nirvali, niroli* Trav. Hills; *Pehimbiya,* Cingh.

An evergreen tree with elegant fern-like leaves. *Wood* very hard, heartwood red. *Pores* small, in groups or short radial lines *Medullary rays* fine, numerous, at unequal distances.

Forests of the Western Gháts from the Nilgiris southwards and up to 5000 ft., abundant in the Anamalais; low country of Ceylon.

A very handsome tree, often cultivated. Wood strong, useful for building. Bourdillon's experiments of 1896 gave: W = 59 lbs., P = 902. Trimen mentions having measured trees of 10 ft. in girth in Ceylon.

	lbs.
W 4622. Travancore (Bourdillon)	65
No. 70, Ceylon Collection, old (Mendis)	68

(No. 114, Ceylon Collection, new, is a grey wood, of different character.)

ORDER XXIX. MELIACEÆ.

A very important Order to the Indian Forester, considering that it contains such valuable timber trees as the Toon and Satinwood, not to mention others. But it is a difficult Order to describe, because, chiefly owing to the imperfection of material from the great evergreen forests, but also to diversity of opinion as to the limits of species, there is still much confusion. I have, after some consideration, thought it best, on the whole, to adopt the arrangement given in Bentham and Hooker's "Genera Plantarum" and the Fl. Br. Ind., instead of that of C. de Candolle's monograph ("Monographiæ Phanerogamaram," vol. i. 1878), with such further alterations as may have been introduced by Sir G. King in his "Malay Contributions." The MELIACEÆ are renowned for their bitter tonic and astringent qualities, and for the excellence of the timber given by almost all the species. Roughly speaking, the Mahogany wood, so well known, may be taken as the type of a Meliaceous wood, for most of the other woods of the Order approximate to it more or less in colour, texture, scent and properties.

The Order is divided into four tribes, containing 21 genera, of which one is introduced—

Tribe I. Melieæ	Turræa, Naregamia, Munronia, Melia, Cipadessa.
„ II. Trichilieæ . . .	Dysoxylum, Chisocheton, Sandoricum, Aglaia, Lansium, Pseudocarapa, Amoora, Walsura, Heynea, Beddomea, Carapa.
„ III. Swietenieæ . . .	Swietenia, Soymida, Chickrassia.
„ IV. Cedreleæ	Cedrela, Chloroxylon.

It may be noted that many authors separate Azadirachta from Melia, some split up Cedrela into Cedrela and Toona, and other changes of less interest have been made in recent works. I think it best, however, in this work, to adhere, as far as possible, to the names to which Forest officers are most accustomed.

Khaya senegalensis, Juss. is the "African mahogany," now much imported for furniture purposes from the west coast of Africa to Europe.

Wood usually red, sometimes yellow or grey, more rarely white, sometimes with irregular concentric bands of loose texture. *Pores* various, rather scanty, generally moderate-sized. *Medullary rays* usually moderate-sized.

Tribe I. MELIEÆ.

1. TURRÆA, Linn. Two species, shrubs or trees, rather imperfectly described. *T. virens*, Linn.; Fl. Br. Ind. i. 541; Talbot Bomb. List 38, is found on the Konkan Ghâts of Western India, apparently chiefly on lava-heaps; while *T. villosa*, Benn.; Fl. Br. Ind. i. 542; Talbot Bomb. List 38, is found in Guzerat, about Mahabaleshwar, in the moist forests of N. Kanara and in the Anamalai Hills of Coimbatore.

2. NAREGAMIA, W. and A. *N. alata*, W. and A.; Fl. Br. Ind. i. 542, is a small glabrous undershrub of the Western Ghâts from the Konkan southwards.

3. MUNRONIA, Wight. *M. Wallichii*, Wight; Fl. Br. Ind. i. 543; Kurz For. Fl. i. 211; Gamble Darj. List 16, is a small, pretty, pink-flowered shrub of the Sikkim-Himalaya, the Khasia Hills, the Nilgiris, and the Pegu Yoma. *M. pumila*, Wight; Fl. Br. Ind. i. 543; Trimen Fl. Ceyl. i. 242; Vern. *Bin-kohomba*, Cingh., is a Ceylon endemic shrub giving a bitter tonic.

4. MELIA, Linn.

Four species. King explains how *M. excelsa*, Jack probably belongs to some other genus.

1. **M. indica**, Brandis For. Fl. 67. *M. Azadirachta*, Linn.; Fl. Br. Ind. i. 544; Roxb. Fl. Ind. ii. 394; Bedd. Fl. Sylv. t. 13 (14 by mistake); Kurz For. Fl. i. 212; Talbot Bomb. List 38. *Azadirachta indica*, A. Juss.; C. DC Monog. i. 459; Trimen Fl. Ceyl. i. 244. The Neem or Margosa tree. Vern. *Azad-darakht, neb*, Pers.; *Nîm*, Hind.; *Betain*, Kumaon; *Agas*, Palamow; *Limbo*, C.P.; *Kohumba*, Guz.; *Nimuri*, Sindi; *Vepa, vempu*, Tam.; *Yapa, yepa, taruka, vempa*, Tel.; *Limb, nimbay*, Mar.; *Bevina, bévu, heb-bévu, kirri bévu*, Kan.; *Tamaka, thinbaw-tamaka*, Burm.; *Kohomba*, Cingh.

A large tree. *Bark* grey, with numerous scattered tubercles. *Wood* hard, close-grained; sapwood grey, heartwood red. *Annual rings* doubtful: the wood shows alternating bands with numerous and with fewer pores; also pale concentric lines, but whether these are annual rings is doubtful. *Pores* scanty, moderate-sized and large, often oval and subdivided; visible on a vertical section. *Medullary rays* fine, numerous, white, prominent, bent outwards where they touch the pores; the distance between the rays less than the transverse diameter of the pores. The wood is scented; it much resembles mahogany.

If wild anywhere in India, it is probably so in the forests of the Carnatic and in parts of the Deccan, perhaps also in the drier inland forests of Burma; elsewhere it is planted or has come up self-sown from planted trees. It is only found in avenues and gardens and about villages in Northern or Western India. J. W. Oliver says it is "wild and cultivated in Upper Burma."

A very important Indian tree, held in great estimation by the natives, who use its leaves very largely in medicine, as food and in their religious ceremonies. Indeed, almost every part of the tree has its use—the bark, the leaves, the flowers, the seeds and the oil they give, the gum, the wood, all have their uses in medicine or as food (see Watt's "Dict. Econ. Prod.," vol. v.). It is an excellent avenue tree, giving shade in the hot season when other trees are bare. It thrives on the black cotton soil.

The weight and transverse strength have been determined by the following experiments:—

		Weight in lbs.	Value of P.
Puckle in 1859, three experiments, with bars 2″ × 1″ × 1″,	found	49	539
Skinner in 1862, No. 19	„	50	720
Cunningham in 1854, two experiments, with bars 2′ × 1″ × 1″	„	52	587
Fowke in Catalogue, South Kensington Museum, 1859	„	45	315
Wallich	„	46	—
Molesworth in "Graphic Diagrams for Strength of Teak Beams"	„	50	736
		E = 2900	
Bourdillon, Travancore, 1896	„	45	961
O'Connell, Madras, 1886	„	50	—
		a = 0·01401	

The average weight may be taken at from 50 to 52 lbs. per cubic foot.

The experiments made by Prof. W. C. Unwin, F.R.S., for the Imperial Institute, on Ceylon woods, gave the following results (*Imp. Inst. Journ.*, May, 1899) :—

Weight	47·32 lbs. per cubic foot.
Resistance to shearing along the fibres	1326 lbs. per square inch.
Crushing stress	2·987 tons per square inch.
Coefficient of transverse strength	5·125 „ „
Coefficient of elasticity	495 „ „

The rate of growth is fairly good; some specimens gave 5 rings per inch of radius.

The wood is durable; it is used for the construction of carts, in ship-building and for making agricultural implements, and in South India for furniture. It is held sacred by Hindus, and idols are made of it. The use of it in furniture is believed to keep off moths and other insects. The bark is bitter and is used as a febrifuge. The leaves are made into a poultice for ulcers. The gum is clear, amber-coloured and used as a stimulant. The seeds are employed to kill insects and for washing the hair. The fruit gives a fixed, acrid, bitter, yellow-coloured oil, which is used to burn, but smokes badly in burning; it is also used in medicine as an antiseptic and anthelmintic.

		lbs.
P 463.	Ajmere (sapwood)	48
C 3647.	Daltonganj, Palamow (Gamble)	—
D 3910.	Gooty, Anantapur „ (much sapwood)	46
D 4200.	Cuddapah (Higgens)	52
D 1053.	Salem, Madras (Beddome)	53
No. 11, Salem Collection		59
No. 75, Ceylon Collection, new (Mendis)		—

Nordlinger's Sections, vol. 5 (called *M. Azedarach*) (Tab. III. 2).

2. **M. Azedarach,** Linn.; Fl. Br. Ind. i. 544; Roxb. Fl. Ind. ii. 395 (also *M. sempervirens*, Sw.); Bedd. Fl. Sylv. t. 14 (13 by mistake); Brandis For. Fl. 68; Kurz For. Fl. i. 212; Gamble Darj. List 16; Talbot Bomb. List 39. The Persian Lilac, Bastard Cedar or Bead tree. Vern. *Darachk*, Kuram Valley; *Chein, kachein*, Sutlej; *Drek, bakáin, bakáyan, betain, deikna, bakarja*, Hind.; *Deknoi*, Jaunsar; *Bitan*, Kumaon; *Denkan*, Garhwal; *Bitrayan*, Dotial; *Maha limbo, malla ním, muhli*, C.P.; *Bakainú*, Nep.; *Pejri, padrai*, Mar.; *Mallay vembu*, Tam.; *Taraka vepa, makáním*, Tel.; *Bévu, chik bévu, heb-bévu*, Kan.; *Thamaga*, Burm.

A deciduous tree. *Bark* grey or greyish-brown, with long shallow vertical fissures. *Wood* soft; sapwood yellowish white; heartwood red. *Annual rings* marked by a broad belt of large pores, the outer part of each annual ring containing a few smaller-sized pores which are joined by irregular, wavy, concentric bands of soft tissue. *Medullary rays* moderately broad; visible in the silver-grain as long rough plates. *Pores* very prominent on a longitudinal section, often filled with resin.

Said to be indigenous in the sub-Himalayan tract up to 6000 ft., but this is doubtful. J. L. Stewart, in "Punjab Plants," says he never saw it truly wild

nywhere. Stocks described it as wild in Baluchistan. Elsewhere it is commonly ultivated all over India and Burma, away to the Shan Hills.

The wood is useful and pretty. Brandis, Beddome and Kurz all say that it warps and plits, but Mr. Halsey of Madhopur described it as very useful either green or seasoned. 'he wood was used at the Imperial Forest School for museum cases and other furniture, nd behaved quite well. The specimens cut for the Paris Exhibition of 1878 only plit slightly, not more than is usual with most woods, so that it may be assumed hat it has been rather unjustly condemned. The growth is quick, often very quick, : to 4 rings per inch of radius. The wood is handsomely marked and takes an xcellent polish. Skinner, No. 92, gives W = 30 lbs., P. = 596; O'Connell gives N = 50, a = 0·01437, the specimens average 38 lbs. weight per cubic foot.

The bark is bitter and is used as an anthelmintic. The fruit gives an oil, and the uts are strung as beads. The leaves and fruit are used in native medicine.

		lbs.
P 145.	Sainj, Giri Valley, Punjab	38
P 946.	Lahore, Punjab (Baden-Powell)	35
P 1201.	Madhopur, Punjab (Halsey)	40

Nordlinger's Sections, vol. 6 (marked *M. Azadirachta*) and vol. 10 (*M. japonica*, G. Don).

Hough's American Woods, vol. v. No. 105.

3. **M. composita**, Willd.; Bedd. Fl. Sylv. t. 12 (excl., as elsewhere, syn. *M. uperba*, Roxb.); Brandis For. Fl. 69; King in Journ. As. Soc. Beng. lxiv. ii. 506. *I. dubia*, Hiern in Fl. Br. Ind. i. 545; Talbot Bomb. List 39; Gamble Darj. List 16; 'rimen Fl. Ceyl. i. 243. *M. robusta*, Roxb. Fl. Ind. ii. 397. Vern. *Eisúr*, *limbarra*, *imbarra*, Bombay; *Dingkurlong*, Khasia; *Mallay vembu*, Tam.; *Bévu*, *betta bévu*, *ád bévu*, Kan.; *Lunu-midella*, Cingh.

A large deciduous tree. *Bark* smooth, dark brown. *Wood* soft; apwood grey, heartwood reddish-white. *Pores* large, generally ound, visible on a vertical section. *Medullary rays* white, fine, canty, prominent in silver-grain. The structure resembles that of 'oon, but all the pores are of the same size and the wood is softer. 'he *annual rings* are marked by more numerous, but not larger pores.

Sikkim Himalaya, up to 6000 ft.; Khasia Hills; Hills of the Western Ghâts in . India and West coast forests from the Konkan down. Moist low country of Ceylon.

Growth rapid; 2 to 3 rings per inch of radius in the Madras specimen; that from engal was moderate, 7 rings per inch. Roxburgh says that a tree of *M. robusta* rown in the Calcutta Botanic Gardens from Malabar seed produced, in seven years, rees 46 feet high, with a girth of 44 in. at 4 ft. from the ground, which is equivalent) one ring per inch of radius. Weight 26 to 33 lbs. per cubic foot; Bourdillon ives W = 26, P = 391.

The experiments made by Prof. W. C. Unwin, F.R.S., for the Imperial Institute, n Ceylon woods, gave the following results (*Imp. Inst. Journ.*, May, 1899):—

Weight	20·39 lbs. per cubic foot.
Resistance to shearing along the fibres	478 lbs. per square inch.
Crushing stress	1·358 tons per square inch.
Coefficient of transverse strength	2·550 „ „
Coefficient of elasticity	330·1 „ „

The wood will probably be found useful for tea-boxes and similar purposes, and the ee should be cultivated on account of its rapid growth. In Ceylon, the outriggers of ative boats are made of this wood, which is highly esteemed also for various other urposes. I do not know why Mendis called it the "Common Bread tree."

		lbs.
E 705.	Great Rangít Valley, Darjeeling (Manson)	33
E 3357.	Kalimpong, Darjeeling, 4000 ft. (Gamble)	—
E 3360.	Rangirúm, „ 5000 ft. „	—
C 4032.	Gumsúr forests, Ganjam (Gamble)	28
D 1093.	Madura, Madras (Beddome)	26
No. 49, Ceylon Collection, old; No. 85 new (Mendis)		26

B 507 (28 lbs.) sent from the Andamans under the name of *Barringtonia speciosa*. Vern. *Kyaigyee*, Burm.; *Doddá*, And., has a wood in every respect similar to that of *M. composita*, but that tree has not yet been reported from the Andaman Islands.

4. M. birmanica, Kurz For. Fl. i. 213. *M. superba*, Roxb. Fl. Ind. ii. 396 (probably, *fide* King). Vern. *Tauthamaga*, Burm.

An evergreen tree. *Bark* ½ in. thick or more, dark brown, corky, deeply fissured vertically. *Wood* soft to moderately hard; sapwood white, heartwood red. *Pores* moderate-sized, often subdivided, scanty, closer in the spring-wood belt, where they mark the *annual rings*. *Medullary rays* fine, numerous.

Tropical forests in Upper Burma and Martaban.

		lbs.
B 4860.	Magwe, Burma (S. E. Jenkins)	—
B 4897.	Minbu, Burma (Calthrop)	40

5. CIPADESSA, Bl.

1. C. fruticosa, Bl.; Fl. Br. Ind. i. 545; Talbot Bomb. List 38; Trimen Fl. Ceyl. i. 245. *C. baccifera*, Miq.; Kurz For. Fl. 214. *Ekebergia indica*, Roxb. Fl. Ind. ii. 392. *Mallea Rothii*, A. de Juss.; Bedd. Fl. Sylv. liv. Vern. *Nal bilá*, Hind.; *Chendbera, purudona*, Tel.; *Kiner*, Khond; *Ranabili*, Uriya; *Hal-bembiya*, Cingh.

A bushy shrub. *Bark* thin, reddish-brown. *Wood* red, moderately hard, with a faint odour resembling that of the Toon wood. *Pores* very fine, numerous, usually in lines between the very numerous close and fine *medullary rays*. These latter are slightly wavy and short, and bend where they meet the pores. The pores are prominent as red lines on a vertical section. *Annual rings* marked by a white line.

Dry stony hills and laterite plateaux of Orissa and the Circars; fairly common in the Deccan and in Western India; Upper Burma and the Shan Hills; low country of Ceylon.

A very common and more or less gregarious shrub in many places on the Eastern Coast and on the ghâts of the Deccan and South Mahratta country. The wood is used for fuel. Growth sometimes quick, 5 to 6 rings per inch of radius; sometimes slow, 16 to 19. Weight about 50 lbs. per cubic foot.

		lbs.
C 3499.	Khurdha Forests, Orissa (Gamble)	50
C 3831.	Kurcholy Forests, Ganjam „	51
C 3988.	Rekapalle Forests, Godavari „	—

Tribe II. TRICHILIEÆ.

6. DYSOXYLUM, Bl.

About 14 species, seven described in Fl. Br. Ind., and the others added since. Six species occur in Northern and Eastern Bengal, two in Burma, four in the Andamans and three in S. India. *D. pallens*, Hiern in Fl. Br. Ind. i. 548, is a tree of the Sikkim Himalaya and the Mishmi and Khasia Hills; and *D. reticulatum*, King in Journ. As. Soc. Beng. lxv. ii. 9, is a tree found in the Tista Valley, in Sikkim and in Cachar. *D. Beddomei*, Hiern in Fl. Br. Ind. i. 548; Vern. *Adanthei*, Tam., is a very large tree of S. Travancore, common about Peermerd. *D. glandulosum*, Talbot Bomb. List 39; Vern. *Bili devdari, bili budlige*, Kan., is a very large tree of the evergreen forests of N. Kanara, whose wood is used in building, and is said to be suited for tea-chests, cigar-boxes and similar purposes. *D. arborescens*, Miq.; *D. thyrsoideum*, Griff.; *D. racemosum*, King, and *D. andamanicum*, King, are all trees of the Andaman Islands, to some of

which probably belong specimens B 2484 (44 lbs.), B 2250 (40 lbs.), and B 2255 (31 lbs.), which have a structure resembling that of *D. procerum*. The leaves of several species give out a strong odour of garlic; the leaves are compound, with oblique, often large leaflets, and the capsules are generally large, containing large brightly coloured seeds.

Wood reddish, rough, moderately hard. *Pores* prominent on a vertical section, moderate-sized to large, often subdivided, or in short strings. *Medullary rays* fine. Concentric lines in some species fairly prominent.

1. **D. binectariferum**, Hook. f.; Fl. Br. Ind. i. 546; Kurz For. Fl. i. 215; Gamble Darj. List 16. *D. macrocarpum*, Bl.; Bedd. Fl. Sylv. liv. t. 150; Talbot Bomb. List 39; Trimen Fl. Ceyl. i. 247; *Guarea binectarifera*, Roxb. Fl. Ind. ii. 240. Vern. *Katongzu*, Lepcha; *Rangirata*, Cachar; *Borogotodhara*, *bandordema*, Ass.; *Agil*, *kadgandha*, Coorg; *Yerindi*, Bombay.

A large evergreen tree. *Wood* red or reddish-grey, rough, close-grained, hard. *Pores* large and moderate-sized, often subdivided. *Medullary rays* moderately broad, red, wavy, irregularly distributed; the distance between the rays generally larger than the transverse diameter of the pores, but occasionally less when they are bent round them.

Sikkim, ascending to 2000 ft.; Assam, Khásia Hills, Chittagong; Western Gháts; moist low country of Ceylon.

Weight: the specimen gives 44 lbs. per cubic foot. The wood is worthy of notice. Kyd (*Guarea Gotodhara*, Ham.) gives weight 40·5 lbs. and P = 290.

		lbs.
E 644.	Khyrbani Forest, Darjeeling Terai (Manson)	44
	Nordlinger's Sections, vol. 9.	

2. **D. procerum**, Hiern in Fl. Br. Ind. i. 547; Kurz For. Fl. i. 214; Gamble Darj. List 16. Vern. *Dingori*, *govorpongyota* (Wall.), Ass.

An evergreen tree. *Wood* bright red, moderately hard. *Pores* large, often oval and subdivided, prominent on a vertical section. *Medullary rays* fine, numerous, wavy, not prominent; the distance between the rays generally equal to the transverse diameter of the pores.

Sikkim, Assam, Khasia Hills and Cachar to Pegu and Tenasserim.

Kyd (*Guarea Gobara*, Ham.) gives weight 47 lbs., P = 617; the specimens weigh from 37 to 40 lbs. It is a handsome wood, well deserving of more extensive notice. It is said by Hamilton to be used for canoes.

		lbs.
E 631.	Eastern Dúars (Mann)	40
E 1434.	Assam	37
E 3595.	Rungdung Forest, Darjeeling Terai (Gamble)	—

3. **D. grande**, Hiern in Fl. Br. Ind. i. 547. Vern. *Bieren*, Sylhet.

A tree. *Bark* ¼ in. thick, dark grey, smooth except for small lenticels. *Wood* moderately hard; sapwood dark greyish-brown, heartwood not seen; with occasional narrow interrupted concentric lines of soft tissue. *Pores* moderate-sized, scanty. *Medullary rays* fine to moderately broad, not numerous.

Sylhet in Eastern Bengal, Kachin Hills.

		lbs.
E 4880.	Sylhet (Babu Krina Nath De) . . .	47

4. **D. Hamiltonii,** Hiern in Fl. Br. Ind. i. 548; Gamble Darj. List 16. Vern. *Bauriphal*, Nep.; *Gendelli poma, bosuniya poma* (Wall.), Ass.; *Bolashin*, Gáro.

A large evergreen tree. *Bark* brownish-red with long scales. *Wood* red, hard, close-grained. *Pores* moderate-sized, rather scanty, usually in strings of 2 to 4. *Medullary rays* fine, uniform; the distance between the rays greater than the transverse diameter of the pores, the rays bent where they meet the pores.

Darjeeling Terai, Assam and Sylhet.

S. E. Peal says this tree is often very large, and that he has measured them 18 ft. girth at 10 ft. from the ground. Growth moderate, 6 rings per inch of radius. Kyd (*Guarea Alliaria*, Ham.) gives weight 40·5 lbs., P = 523; the specimens average 40 lbs. per cubic foot. The wood is used in Assam for boats and planks, but is said not to be durable. Hamilton says it is used for canoes.

		lbs.
E 1259.	Tezpur, Assam (Mann)	47
E 2189.	Nowgong, Assam „	36

Nordlinger's Sections, vol. 10 (Tab. III. 3).

5. **D. malabaricum,** Bedd.; Fl. Br. Ind. i. 548. *D.* sp. Bedd. Fl. Sylv. liv. White cedar. Vern. *Velley agil*, Tam., Mal.; *Porapá*, Kader.

A very large tree. *Wood* light red, hard, close-grained, elastic. *Pores* moderate-sized, numerous, evenly distributed, sometimes in fine concentric white lines, sometimes alone. *Medullary rays* fine, numerous.

Forests of the Western Gháts, in Coorg, Malabar, the Anamalai Hills and Travancore at about 1–3000 ft.

Bourdillon says, "A very lofty tree, wood sweet-scented, used for oil-casks." He gives weight 45 lbs.

		lbs.
W 4534.	Travancore (Bourdillon)	51

There is also the "white cedar" wood sent me by the late Mr. H. R. P. Carter, when Engineer-in-chief of the Madras Railway. The *wood* is light orange-red, with numerous dark concentric lines which cannot be annual rings though they look like it. *Pores* moderate-sized, scanty. *Medullary rays* fine, numerous (W. 4234). It might perhaps be a *Chisocheton*.

6. **D. purpureum,** Bourdillon in Journ. Bomb. Nat. Hist. Soc. xii. 349. Vern. *Kár agil*, Mal.

A very large tree. *Bark* pale, smooth. *Wood* reddish-brown, hard. *Pores* small to moderate-sized, very scanty, single or in short radial groups of 2 to 3, joined by very narrow but prominent pale concentric, wavy, often interrupted, lines. *Medullary rays* fine, short, not numerous. *Annual rings* marked by dark lines.

Forests of the Ravi river in Travancore at 1–2000 ft.

This is a very large tree growing up to 100 ft. in height and 10 ft. in girth. Bourdillon gives the weight of the excellent useful-looking wood at 52 lbs., and P = 708. Growth fast, about 6 rings per inch of radius.

		lbs.
W 4623.	Travancore (Bourdillon)	52

7. CHISOCHETON, Blume. Four species. *C. dysoxylifolius*, Hiern in Fl. Br. Ind. i. 551 (*Schizochiton dysoxylifolius*, Kurz i. 215), is a large tree discovered by Brandis in the Thaungyin Forests in Tenasserim. *C. grandiflorus*, Hiern is an evergreen tree of the tropical forests of Martaban, with, according to Kurz, a pale brown, heavy, close-grained, hard wood. *C. paniculatus*, Hiern in Fl. Br. Ind. i. 552; Gamble Darj. List 16 (*Guarea paniculata*, Roxb. Fl. Ind. ii. 242; *Schizochiton paniculatus*, Kurz For. Fl.

i. 216); Vern. *Bandriphal*, Nep.; *Kalikoura*, Sylhet, is an evergreen tree of the Sikkim Himalaya, Assam Valley, Khasia Hills, Cachar and Upper Burma. (E 4869 Lakhimpur, Assam (F. H. Cavendish); Vern. *Bandordema*, 30 lbs., has been sent as this species, but I feel doubtful of its accuracy. *Wood* soft, greyish-white. *Pores* moderate-sized to large, scanty, often subdivided. *Medullary rays* fine, numerous.) *C. costatus*, Hiern in Fl. Br. Ind. i. 552, is a tree of Cachar.

8. SANDORICUM, Cav.

1. **S. indicum,** Cav.; Fl. Br. Ind. i. 553; Roxb. Fl. Ind. ii. 392; Bedd. Fl. Sylv. lv.; Kurz For. Fl. i. 217. Vern. *Thitto*, Burm.

An evergreen tree with grey, not very rough, *bark*. Sapwood grey; heartwood red, moderately hard, close-grained, takes a beautiful polish. *Pores* small, oval and subdivided. *Medullary rays* fine, undulating, not prominent; marked as long narrow bands in the silver-grain.

Tropical forests in Burma; introduced only in Southern India.

Weight: specimen examined gives 36 lbs. per cubic foot; Wallich, No. 175, gives 28 lbs. The wood is used for carts and boat-building.

		lbs.
B 804.	Burma (Ribbentrop)	36

9. AGLAIA, Lour.

Nine species are described in the Fl. Br. Ind.; four more have been added by Kurz, another four by Cas. de Candolle, three by King, and one by Bourdillon. But several of these must be quite rare. There are apparently about six species in Assam and Eastern Bengal, three in South India, two in Ceylon, about seven in Burma, and five in the Andamans. *A. apiocarpa*, Hiern in Fl. Br. Ind. i. 555; Trimen Fl. Ceyl. i. 245, is a small Ceylon tree considered by both Beddome and Trimen not to differ from *A. Roxburghiana*. *A. Wallichii*, Hiern is a tree of Sylhet; *A. perviridis*, Hiern and *A. khasiana*, Hiern are trees of the Khasia Hills; and *A. Chittagonga*, Miq.; Kurz For. Fl. i. 218, is a tree of Chittagong and Arracan. *A. edulis*, A. Gray; Fl. Br. Ind. i. 556; Gamble Darj. List 16 (*Milnea edulis*, Roxb. Fl. Ind. i. 637); Vern. *Lati mahwa*, Nep.; *Sinakadang*, Lepcha; *Gúmi*, Sylhet, is a pretty tree of the Darjeeling hills up to 3000 ft., and of Sylhet, with edible fruit. *A. minutiflora*, Bedd. Ic. Pl. Ind. Or. i. 44, t. 193; Fl. Br. Ind. i. 557; Vern. *Nir mulei*, Travancore Hills, is a tree of the Anamalai Hills and the hills of Travancore in South India. *A. paniculata*, Kurz For. Fl. i. 219, is the most common of the species found in Burma. *A. odorata*, Roxb., is a Malay tree occasionally cultivated in Indian gardens.

1. **A. Roxburghiana,** W. and A.; Fl. Br. Ind. i. 555; Bedd. Fl. Sylv. t. 130; Talbot Bomb. List 40; Trimen Fl. Ceyl. i. 246. Vern. *Yerra aduga*, Tel.; *Chokkala, kanna kompu*, Tam.

An evergreen tree. *Bark* light brown, smooth, peeling off in flat rectangular scales. *Wood* bright red, hard, close-grained, handsomely marked. *Annual rings* (?) distinguished by a darker belt. *Pores* small, scanty, in narrow rings of whitish tissue which run concentrically and appear on a cross-section as narrow wavy lines. *Medullary rays* fine, numerous, evenly distributed; the distance between them equal to or less than the diameter of the pores.

Northern Circars, hills of the Deccan and Western Ghâts, usually in ravines near water, and under shade.

A pretty tree with a handsome wood. Growth fast, 4 to 5 rings per inch of radius. Bourdillon gives W = 57 lbs., P = 896, and says the wood is useful for the spokes of wheels.

		lbs.
C 3964.	Rumpa Hills, Godavari, 3000 ft. (Gamble)	58
D 3969.	Ballipalle, Cuddapah, 1000 ft. „	—
W 4582.	Travancore (Bourdillon)	61

2. A. Malæ, Bourdillon in Journ. Bomb. Nat. Hist. Soc. xii. 350.

A moderate-sized tree. *Bark* mottled brown and white, smooth, ¼ in. thick. *Wood* dark reddish-brown, hard, close and even-grained, smooth. *Pores* moderate-sized, resinous, scanty, joined by narrow irregular interrupted concentric wavy bands. *Medullary rays* fine, numerous, regular, with a marked silver grain on a radial section.

Forests about Ariyaukam and Colatoorpolay in Travancore at 5–1500 ft. An excellent-looking wood. Bourdillon gives W = 70 lbs., P = 1061.

	lbs.
W 4535. Travancore (Bourdillon)	56

10. LANSIUM, Rumph. *L. anamalayanum*, Bedd. Fl. Sylv. t. 131; Talbot Bomb. List 40; Vern. *Santhana viri*, Tam.; *Vandakamin*, Mal.; *Thevathâli*, Trav. Hills, is a tree of the Western Ghâts in Kanara, Wynaad, the Anamalai Hills and Travancore up to 2000 ft., with a sweet-scented wood and more or less edible fruit. *L. domesticum*, Jack, is a Malay tree which gives an excellent fruit, much esteemed in Java, where it is known as "*doekoe*."

11. PSEUDOCARAPA, Hemsl. *P. Championii*, Hemsl.; Trimen Fl. Ceyl. i. 248, t. 24 (*Amoora Championii*, Bth. and Hook. f.; Fl. Br. Ind. i. 562; Bedd. Fl. Sylv. lv.); Vern. *Gonapana*, Cingh., is a very large tree with rough grey bark and hard, heavy, close-grained reddish wood. It is endemic in Ceylon in the moist region at 1–4000 ft. Ceylon Collection No. 41 (new), Mendis, is "Gonapana," but the wood is grey and seems very doubtful.

12. AMOORA, Roxb.

Eight species are described in the Fl. Br. Ind., to which Kurz has added two, and Cas. DC has added two more, total 12. Of these, four species occur in Northern and Eastern Bengal and Assam, three in Southern or Western India, two in Ceylon and seven in Burma. *A. Chittagonga*, Hiern in Fl. Br. Ind. i. 560; Vern. *Thitpasaing*, Magh, is a tree of Assam, the Khasia Hills and Chittagong, with an excellent timber. *A. canarana*, Bth. and Hook. f.; Fl. Br. Ind. i. 560; Talbot Bomb. List 41, is a tree of the forests of the Western Ghâts from North Kanara to the Anamalai Hills; and *A. Lawii*, Bth. and Hook. f.; Fl. Br. Ind. i. 561; Bedd. Fl. Sylv. t. 133; Talbot Bomb. List 41; Vern. *Madrasadu*, Kan.; *Burumb*, Mar., is a tree of the forests of the Konkan and N. Kanara, common at Ainshi Ghât.

Wood hard, close-grained, red, with a darker-coloured heartwood. *Pores* small to large, often subdivided, visible or prominent on a vertical section. In *A. Rohituka* the pores are joined by wavy concentric bands of soft texture. *Medullary rays* moderately broad, uniform.

1. A. Rohituka, W. and A.; Fl. Br. Ind. i. 559; Bedd. Fl. Sylv. t. 132; Brandis For. Fl. 69; Kurz For. Fl. i. 220; Gamble Darj. List 16; Talbot Bomb. List 41; Trimen Fl. Ceyl. i. 249. *Andersonia Rohituka*, Roxb. Fl. Ind. ii. 213. Vern. *Rohituka*, Sans.; *Harin harra, harin khana*, Hind.; *Sohága*, Oudh; *Tikta-raj, pitraj*, Beng.; *Bandriphal*, Nep.; *Tangarúk*, Lepcha; *Lota amari, amora amari*, Ass.; *Okhioungza, okhyang*, Magh; *Sikru*, Kól; *Chem-maram*, Mal.; *Thitni, thanthatkyi*, Burm.

An evergreen tree. *Bark* thin, grey. *Wood* reddish, close- and even-grained, hard. *Pores* small and moderate-sized. *Medullary rays* moderately broad, uniform and equidistant, distinctly visible on a radial section. Pores joined by reddish, soft, wavy, concentric lines. The concentric bands in this species are remarkable, as they are absent from the two other species here described.

Moist ravines of the Gonda forests in Oudh; forests of the Sikkim Terai and Lower hills up to 6000 ft.; Assam, Sylhet, Cachar and Chittagong; tropical slopes of the hills

of Burma up to 3000 ft.; evergreen forests of the Western Ghâts, in the Konkan, North Kanara and southwards, especially the Anamalais; moist region of Ceylon; Andamans and Cocos Islands.

A handsome tree, sometimes planted for ornament.

The wood is good, but little used, in Chittagong canoes are sometimes made of it. Average weight, 40·5 lbs. per cubic foot. In Bengal, an oil is expressed from the seeds.

		lbs.
O 1362.	Gonda, Oudh (Dodsworth)	42
E 2331.	Mangwa, Darjeeling, 6000 ft. (Gamble)	36
E 1261.	Tezpúr, Assam (Mann)	39
E 711.	Chittagong (Chester)	45

2. **A. cucullata,** Roxb.; Fl. Br. Ind. i. 560; Bedd. Fl. Sylv. lv.; Kurz For. Fl. i. 221. *Andersonia cucullata,* Roxb. Fl. Ind. ii. 212. Vern. *Amúr, latmi, natmi,* Beng.; *Thitni,* Burm.

A moderate-sized evergreen tree. *Bark* thin, grey. *Wood* red, hard, close-grained, but apt to split. *Pores* small and moderate-sized, joined by narrow concentric lines of lighter colour. *Medullary rays* very fine, uniform, very numerous.

Coast forests of Bengal and Burma, common in the Sundarbans.

This tree is found in low-lying swampy localities near water-channels, associated with "pussur." It sends up blind root-suckers. Weight 43 lbs. per cubic foot. The wood is used for posts and other purposes in Lower Bengal, and for firewood.

		lbs.
E 414.	Sundarbans (Richardson)	44
E 3697.	„ (Gamble, 1882)	42

3. **A. Wallichii,** King in Journ. As. Soc. Beng. lxiv. ii. 544. *A. spectabilis,* Hiern *non* Miq. in Fl. Br. Ind. i. 561; Kurz For. Fl. i. 221. Vern. *Amari,* Ass.

An evergreen tree. *Bark* thin, even, grey. *Wood* red, hard, close-grained. *Pores* moderate-sized and large, often oval and subdivided, distinctly visible on a longitudinal section. *Medullary rays* fine, clear, uniform, equidistant, prominent on a radial section, the distance between them less than the transverse diameter of the pores, passing round them or stopping at them.

Eastern moist zone. Sikkim, Assam, Burma and the Andaman Islands.

"A magnificent tree and an equally magnificent timber, for furniture and such work, 'at times it reaches 50 ft. in the bole with 8 to 9 ft. girth, and quite straight" (S. E. Peal in *Ind. Tea Gaz.*). The wood is used for boat-building and furniture in Assam. This is probably Kyd's *Guarea (Amari),* weight 47 lbs., P = 792.

		lbs.
E 1255.	Tezpur, Assam (Mann)	49
E 2192.	Nowgong, Assam „	48
	Nordlinger's Sections, vol. 10.	

4. **A. decandra,** Hiern in Fl. Br. Ind. i. 562; Gamble Darj. List 17. Vern. *Tangarúk,* Lepcha.

A tree with thin grey *bark.* *Wood* pinkish white, hard. *Pores* small, scanty, joined by wavy, occasionally concentric, bands of soft tissue. *Medullary rays* fine, numerous.

Eastern Himalaya, at 2–6000 ft.; Kachin Hills of Upper Burma.

E 3392. Lebong, Darjeeling, 5500 ft. (Gamble).

13. WALSURA, Roxb.

Ten species, of which seven are described in Fl. Br. Ind., two added by Kurz and one by King. Two species occur in Northern and Eastern Bengal, one in the Circars, one in South India, two in Ceylon, three in Burma, and four in the Andamans. *W.*

Gardneri, Thw.; Fl. Br. Ind. i. 563; Bedd. Fl. Sylv. lvi.; Trimen Fl. Ceyl. i. 250, is a small endemic tree of the moist region of Ceylon. *W. tubulata*, Hiern is a tree of the forests of the Sikkim Himalaya and Khasia Hills; and *W. ternata*, Roxb. Fl. Ind. ii. 389; Fl. Br. Ind. i. 563; Bedd. Fl. Sylv. lvi.; Vern. *Chinna walursi*, Tel., is a small tree of the forests of the Northern Circars down to the Godavari. *W. villosa*, Wall.; Fl. Br. Ind. i. 564; Kurz For. Fl. i. 223; Vern. *Gyobo*, Burm., and *W. pubescens*, Kurz For. Fl. i. 225, are evergreen trees of Burma, the former often found in Eng forests or in stunted forests on laterite, the latter in damp localities.

1. **W. piscidia,** Roxb. Fl. Ind. ii. 387; Fl. Br. Ind. i. 564; Bedd. Fl. Sylv. lvi.; Talbot Bomb. List 41; Trimen Fl. Ceyl. i. 250. Vern. *Walsura, chadavakku*, Tam.; *Walursi*, Tel.; *Kirikon, mol-petta*, Cingh.

A moderate-sized tree. *Bark* $\frac{1}{6}$ in., greyish-brown, tessellated in somewhat rectangular squares. *Wood* hard; sapwood reddish-brown, heartwood dark red, much streaked with black, close-grained. *Pores* small, clear, surrounded and joined together by wavy anastomozing concentric belts of light tissue. *Medullary rays* very fine, clear and regularly distributed.

Forests of the Northern Circars and Carnatic; those of the Konkan, S. Mahratta country and Kanara, and southwards to Travancore; dry region of Ceylon.

The wood is used, according to Beddome, for various purposes in S. India, and the pulp of the fruit to intoxicate fish. Bourdillon gives W = 59 lbs., P = 947.

		lbs.
D 4232.	Cuddapah Forests (Gamble)	—
W 4627.	Travancore (Bourdillon)	61

2. **W. robusta,** Roxb. Fl. Ind. ii. 386; Fl. Br. Ind. i. 565; Kurz For. Fl. i. 223. Vern. *Upphing*, Sylhet; *Gyobo*, Burm.

A large evergreen tree. *Wood* light red, very hard. *Pores* small, joined by numerous, prominent, wavy, concentric lines. *Medullary rays* very fine, numerous.

Assam, the Khasia Hills and Sylhet; tropical forests of Pegu, Martaban and Tenasserim; Andaman Islands.

		lbs.
W 1986.	Andaman Islands (Kurz, 1866)	63

14. HEYNEA, Roxb.

1. **H. trijuga,** Roxb. Fl. Ind. ii. 390; Fl. Br. Ind. i. 565; Brandis For. Fl. 70; Gamble Darj. List 17; Talbot Bomb. List 42. *H. affinis*, Bedd. Fl. Sylv. t. 134. *Walsura trijuga*, Kurz For. Fl. i. 225. Vern. *Yakushi, ukhaterwa*, Nep.; *Takta*, Lepcha; *Limbara*, Bombay; *Gundira*, Mar.; *Kora*, Kan.; *Korakadi*, Mal.

A small tree. *Bark* thin, rough, reddish-brown, with lozenge-shaped depressed lenticels. *Wood* grey, when young yellowish-white, moderately hard. *Pores* small, often subdivided, in groups or in short radial strings, surrounded with white tissue and arranged in wavy concentric lines. *Medullary rays* fine, short, numerous.

Central and Eastern Himalaya, from Kumaon and Oudh to Bhutan up to 4000 ft.; Khasia Hills and Burma; hills of Chota-Nagpore; hills of the Western Ghâts up to 6000 ft., common in N. Kanara and Nilgiris.

A pretty little tree, often cultivated. The seeds give an oil used to burn by Nepalese.

		lbs.
C 3459.	Bandgaon, Singbhúm, 2000 ft. (Gamble)	—
C 3948.	Rekapalle Forests, Upper Godavari (Gamble)	—
C 3963.	Rumpa Forests, Godavari, 3000 ft. „	54

15. BEDDOMEA, Hook. f. Two species: *B. indica*, Hook. f.; Fl. Br. Ind. i. 566; Bedd. Fl. Sylv. lvi., a large shrub; and *B. simplicifolia*, Bedd. Fl. Sylv. t. 135; Fl. Br. Ind. i. 566, a tree, of the Western Ghát forests from S. Canara and Coorg down to Travancore.

16. CARAPA, Aubl.

Prain, in *Journ. As. Soc. Beng.* lx. ii. 221, explains that he finds it difficult to believe that *C. obovata*, Bl. and *C. moluccensis*, Lamk. are the same species, for the former grows on muddy flats and in mangrove swamps, while the latter is common on rocky coasts. Not knowing exactly to which of the two the wood specimens examined belong, I think it best to consider them as belonging to one species, as in the first edition.

It may be as well, however, to say that in the Sundarbans Working Plan Mr. Heinig considers them as varieties of the same species, with the following differences:—

1. *moluccensis.* Reserved Forests east of the Arpangassia. Grows to 60 ft. in height. Sends up blind root-suckers. Fruit, size of an orange, gives an oil.

2. *obovata.* Same localities. Grows to 40 ft. in height. Has no blind root-suckers. Fruit, size of a shaddock, used in tanning.

If also, as he seems to think, the woods differ, the case for their being separate species seems strong.

Sir D. Brandis tells me that the Sundarbans tree is *C. obovata*, and that *C. moluccensis* is only a Malay species extending to the Andamans.

1. C. moluccensis, Lam.; Fl. Br. Ind. i. 567; Bedd. Fl. Sylv. t. 136; Talbot Bomb. List 42; Trimen Fl. Ceyl. i. 251. *C. obovata*, Bl.; Kurz For. Fl. i. 226. Vern. *Poshúr, pussur, dhundul*, Beng.; *Kandalanga, somunthiri*, Tam.; *Pinlèôn*, Burm.

A moderate-sized evergreen tree. *Bark* thin, grey, peeling off in regular flakes. *Wood* red, hard; sapwood lighter. *Pores* small to moderate-sized, often subdivided, scanty. *Medullary rays* prominent, fine, numerous, uniform and equidistant. *Annual rings* distinctly marked by a continuous belt of pores, and a dark line.

Coast forests of Bengal, Malabar, Burma and Ceylon.

One of the principal trees of the mangrove forests; and one of the best timber-givers in the Sundarbans. It reaches a height of 45 ft., and the wood is used for building, furniture and firewood (Schlich).

Captain Baker, in May, 1829, in *Gleanings in Science*, spoke of *Pussur* or *Pussooah* as being a jungle wood of a deep purple colour, extremely brittle and liable to warp. He said that native boats made of the best species last about three years, and that the wood, if of good quality, stands brackish water better than Sál. The average of his experiments made in 1825–6 with pieces 6′ × 1½″ × 2″ gave W = 47 lbs., P = 526; specimens examined give W = 43 lbs.; Brandis, No. 24, Burma List, 1862, gives 47 lbs.; Wallich, 47 lbs. The wood is used in Burma for house-posts, handles of tools and wheel-spokes; it gives a clear, brown, brittle resin. The fruit yields an oil used for burning and for the hair. Growth moderate, 6·6 rings per inch of radius.

		lbs.
E 402.	Sundarbans (Richardson)	41
E 3696.	„ (Gamble, 1882)	49
B 2514.	Burma (Brandis, 1862)	42
B 2239.	Andamans (Col. Ford, 1866)	41
D 4114.	South Arcot (Wooldridge)	43

Tribe III. SWIETENIEÆ.

17. SWIETENIA, Linn.

Two introduced trees, much cultivated in India in gardens, avenues and forest plantations.

1. S. Mahagoni, Linn.; Brandis For. Fl. 70. The Mahogany tree.

A large evergreen tree. *Wood* hard, reddish-brown, seasons and

works well. *Annual rings* marked by a continuous line of pores, with few or no pores in the autumn wood. *Pores* moderate-sized, scanty, uniformly distributed, often subdivided, sometimes filled with resin. *Medullary rays* very short, very numerous, moderately broad, uniform and equidistant, giving a handsome silver-grain.

Jamaica and Central America; cultivated in Bengal and as far north as Saharanpur.

The tree was introduced into the Royal Botanic Garden at Calcutta in 1795 (plants from the West Indies), and although it was largely propagated by layers, no further new introductions were probably made until 1865, when about 8000 seeds were sown in Calcutta by Dr. T. Anderson. A number of these seeds did not succeed, but in the end 460 plants were procured, three-fourths of which were planted in the Mohurgong Forest in the Darjeeling Terai, and the remainder at Calcutta. The plantation at Mohurgong was a failure, but the growth of Mahogany at the Calcutta Botanic Garden, and at other places in Bengal to which it was distributed, has been very satisfactory. The experiment has been continued in Bengal, South India and Burma, and in time it may be hoped that the conditions under which the tree thrives will be so well ascertained that it can be regularly planted for timber. It apparently thrives best near the sea. In a report submitted to Government by Dr. T. Anderson, of December 27, 1866, he states that three trees, presumably 73 years of age, gave, at 4 ft. from the ground, girths of 14 ft. 3 in., 12 ft. 3 in. and 13 ft. respectively, equivalent to a growth of 3·11 rings per inch of radius. In the great cyclone of 1864 a number of the trees originally introduced in 1795 were blown down; they had then, most of them, attained 12 ft. in girth at 4 ft. from the ground, and logs cut from them sold at 4½ to 5 annas per superficial foot 1 in. thick, or at about Rs.3.6 annas per cubic foot.

The results of measurements of Saharanpur trees were as follows:—

5 trees planted in 1827–28, measured in May, 1872, gave 3·41 rings per inch.
2 " " 1839 " " " 4·78 " "
3 " " 1842–43 " " " 6·09 " "

The mean growth being 4·94 rings and an age of 58 years, corresponding to 6 ft. in girth. The growth in Calcutta gave only 36 years for the same size. Measurements made in Akyab by Mr. J. Nisbet ("Ind. For." vii. 219) gave an average radial growth of 5 in. in 4 years, which is extremely quick. A section cut at Nilambur (W 4288) showed a growth of 2·2 rings per inch. The result of these few data seems to show that the growth near the sea in a moist equable climate is *very* quick, and that as one goes inland and the climate gets drier the growth gets less, though at such a distance as Saharanpur, 1000 miles from the sea, with a frosty winter season, the growth is still fast, averaging 5 rings per inch. This all seems to point to the advisability of its artificial cultivation being more largely extended, especially near the sea and on good soil. On poor soil it will not thrive, as is natural considering that its home is in the dense forests of the West Indies, where the soil has probably many feet of humus and rich mould. It has been successfully grown at Nilambur, at Kullar at the foot of the Nilgiris and elsewhere; at Bamunpokri in the Darjeeling Lower Hills it was a failure, also in various other places, such as Dehra Dún, where there are trees, but of unhealthy growth.

The weight of Mahogany wood varies much. Tredgold gives for Honduras wood 35 lbs. and for Spanish Mahogany 53 lbs., and Fowke gives 52 lbs. as the weight of Jamaica Mahogany. Our Calcutta specimen, cut from one of the trees destroyed in the 1864 cyclone, gave 45 lbs., and the Saharanpur one 43 lbs. Tredgold gives for the value of P for Honduras wood 637, for Spanish Mahogany 425; Fowke gives for Jamaica wood 546. Molesworth gives for Honduras wood W = 35 lbs., P = 615, E = 3100. Laslett's experiments give the following results:—

	Weight in lbs.	Value of P.
Cuba Mahogany, 6 experiments, bars 7′ × 2″ × 2″ (6 ft. between supports)	48	642
Honduras Mahogany, 6 experiments, bars 7′ × 2″ × 2″ (6 ft. between supports)	41	601
Mexican Mahogany, 6 experiments, bars 7′ × 2″ × 2″ (6 ft. between supports)	42	587

For India, W may be taken ordinarily as = 44 lbs. and P = 600.

In Europe the wood is, perhaps, used more extensively than any other for furniture; it is also used in ship-building. In the Calcutta market it fetched, in 1878, from 6½ to 8 annas per superficial foot of planking one inch thick; and in London from 4*d.* to 1*s.* 6*d.*

Planted trees suffer a good deal from the attacks of the Toon borer moth, *Magiria robusta*, Moore.

		lbs.
E 1361.	Royal Bot. Garden, Calcutta (King)	45
O 4568.	Saharanpur Bot. Garden (Gollan)	43
W 4288.	Nilambur Pln., Malabar (P. Lushington)	23 (young)

Nordlinger's Sections, vol. 10 (Tab. III. 4).

2. S. macrophylla, King in Hook. Ic. Pl. t. 1550.

A large tree. *Bark* brown, rather rough. *Wood* light red, moderately hard. *Pores* small, scanty. *Medullary rays* fine, the distance between them about equal to the diameter of the pores. Occasional concentric bands of light tissue, some of which may be annual rings.

Introduced from the W. Indies.

The history of this species is as follows (see "Ind. For." xv. 55). In 1872 seeds of mahogany were sent by the India Office to the Royal Bot. Garden in Calcutta. They were said to be from Honduras. As soon as the seedlings were a few inches high, they were recognized as not belonging to *S. Mahagoni*. In their twelfth year, some of the young trees had reached 20 ft. in height and begun to flower, and in 1885 they seeded. The material obtained enabled Sir G. King to describe the tree.

It is a beautiful tree, far more hardy than *S. Mahagoni*, and as it seeds freely, it is being largely cultivated in many places in India. The wood is similar, but seems likely to be not quite of so good quality as the true Mahogany; but this, time alone can prove satisfactorily.

		lbs.
E 3923.	Royal Bot. Garden, Calcutta (King)	35

18. SOYMIDA, Adr. Juss.

1. S. febrifuga, Adr. Juss.; Flor. Br. Ind. i. 567; Bedd. Fl. Sylv. t. 8; Brandis For. Fl. 71; Kurz For. Fl. i. 228; Talbot Bomb. List 42. *Swietenia febrifuga*, Willd.; Roxb. Fl. Ind. ii. 398. Indian Red Wood. Vern. *Rohan*, Hind.; *Rohina*, Beng.; *Rohan, rohini, pohora*, Berar; *Shem, wond*, Tam.; *Sumi*, Tel.; *Sohan, suam*, Uriya; *Soimi*, Gondi; *Royta*, Bhil; *Somangi*, Khond; *Soymide*, Palkonda; *Palara*, Mar.

A large deciduous tree. *Bark* ¼ to ½ in. thick, bluish-grey or dark brown. Sapwood small, whitish; heartwood extremely hard and close-grained, very dark red-brown, very durable, with numerous fine, concentric lines of lighter colour, often closely packed. *Pores* moderate-sized, scanty. *Medullary rays* moderately broad, distinctly visible on a radial section as dark shining plates, making, with the sections of the dark pores, a very pretty silver-grain having a satiny lustre.

Dry forests of Central and South India, found, according to Brandis, at its northernmost limit in the Banswara State of Rajputana and the Mirzapore Hills. It is, however, most common in the C. P., Orissa and the Circars, but extends also across the Deccan to the Konkan Ghâts and the S. Mahratta country, and southwards into the Carnatic. It prefers low hills of laterite and kankar, and is often associated with Satinwood.

A beautiful and interesting tree, with a valuable wood. The latter is somewhat cross-grained, like Sál and some others, owing to the fibres in different vertical layers going in different directions, so that it is difficult to plane. In Ganjam, where it is very common, it is rarely cut, as the villagers and the Khonds consider it an unlucky tree.

and so large trees are not uncommon. When good pieces are obtainable it makes beautiful furniture, if well seasoned to begin with.

Weight, according to Skinner, No. 117, and Fowke, 66 lbs.; R. Thompson gives 71, and Bombay specimens gave 76; Wallich (*Swietenia febrifuga*) 55 lbs.; the specimens give an average of 74 lbs. According to Skinner's experiments, the value of P is 1024, Fowke gives 626. The wood is durable. Skinner says that a scantling 3′ × 1½″ × 1½″, taken out of the workshop at Fort Saint George, which had been erected in 1803 and pulled down in 1859, stood 1232 lbs. without breaking. It is not much attacked by white ants. It is used for construction, well-work, ploughshares and oil-mills. The bark is bitter, and is used as a febrifuge and in diarrhœa and dysentery. For Mr. Broughton's opinion of it and its chemical properties, see Bedd. t. 8.

It gives a beautiful clear gum in large pieces, and this gum is said by Dymock to afford a good mucilage. The bark may be used in tanning, giving a brown colour; and it also gives a strong red rope-fibre.

		lbs.
C 194.	Mandla, Central Provinces, 1871	73
C 1123.	Ahiri Reserve, Central Provinces (R. Thompson) . . .	72
C 1240.	Gumsúr, Ganjam (Dampier)	74
C 3824.	Gullery Forest, Gumsúr (Gamble)	77
D 4060.	Godavari Forests (Gamble)	73
D 2113.	Mysore	75

19. CHICKRASSIA, Adr. Juss.

1. **C. tabularis**, Adr. Juss.; Fl. Br. Ind. i. 568; Bedd. Fl. Sylv. t. 9; Brandis For. Fl. 73; Kurz For. Fl. i. 227; Talbot Bomb. List 42; Trimen Fl. Ceyl. i. 252. *C. velutina*, Roemer: Kurz For. Fl. i. 227. *Swietenia Chickrassa*, Roxb. Fl. Ind. ii. 399. Chittagong wood. Vern. *Chikrassi*, Beng.; *Boga poma*, Ass.; *Aglay*, *agal*, *eleutharay*, Tam.; *Madagari vembu*, Tel.; *Ganti malle*, Salem; *Dalmara*, Kan.; *Pabba*, *lál devadari*, Mar.; *Main*, Hyderabad; *Mallei vepu*, Trav. hills; *Saiphra*, *sey barasi*, Magh; *Chegarasi*, Chakma; *Yinma*, *tawyinma*, Burm.; *Arrodah*, And.

A large tree. *Bark* reddish-brown, deeply cracked. *Wood* hard, varying from yellowish-brown to reddish-brown, with a beautiful satiny lustre, seasons and works well; sapwood of a lighter colour. *Pores* scanty, moderate-sized, often oval and subdivided, isolated, uniformly distributed. *Medullary rays* fine, uniform, mostly equidistant, slightly undulating; the distance between the rays generally equal to the transverse diameter of the pores. *Annual rings* distinctly marked by a sharp line. A fine silver-grain with a satiny lustre. Like *Soymida*, it is difficult to plane owing to the fibres running in different directions.

Forests of the Sikkim Himalaya, scarce; Assam, Eastern Bengal and Chittagong, common, especially in the latter, where, after Jarúl, it is probably the chief timber tree; throughout South India on both sides, but especially in the W. Gháts, also in Ceylon; forests of Burma from the Shan Hills down; Andaman and Cocos Islands.

A beautiful tree with a fine furniture-wood, such as in Europe is used for piano-cases, tables, etc. Roxburgh says of it, "It is of a light colour and most elegantly 'veined, at the same time very close in the grain; it is employed to make furniture of 'different kinds." It deserves to be better known, and perhaps exported from localities in which, as in the Chittagong Hills, it is sufficiently common. It would also be worth cultivation in suitable places.

From the description given, it is probable that this is the "*Cul gerweygay*, Kan." of Graham Anderson's list, said to be very prejudicial to coffee if used as a shade tree.

Growth moderate, 8·6 rings per inch of radius. Weight, according to Skinner, No. 46, 42 lbs.; the specimens give an average of 49 lbs. Skinner's experiments give P = 614. The wood is used for furniture and for carving. The bark is a powerful astringent, and the flowers give a red or yellow dye. It also gives a gum, apparently not used.

		lbs.
E 3678.	Darjeeling Lower Hills (Gamble)	54
E 1260.	Tezpúr, Assam (Mann)	40
E 2197.	Nowgong, Assam „	45
E 1401.	Chittagong (Chester)	49
E 3689.	Chittagong (Gamble)	55
D 3979.	Agri-Hortl. Gardens, Madras (Steavenson)	59
W 764.	South Kanara (Cherry)	43
W 1218.	North Kanara (Barrett)	44
B 2516.	Burma (Brandis, 1862)	52
	Nordlinger's Sections, vol. 10.	

Tribe IV. CEDRELEÆ.

20. CEDRELA, Linn.

In the Fl. Br. Ind. all the species or varieties of "Toon" are brought together under one, *C. Toona*. But no one who has ever seen *C. serrata*, or indeed *C. microcarpa*, could possibly think that as species they were identical with *C. Toona*. In Cas. de Candolle's Monograph, luckily, we have the Cedrelas properly described, and five species are made, to which Sir G. King has added another. *C. glabra*, Cas. DC is a large tree found by Wallich in Nepal. It has also been collected in Kumaon, and King says it is only a variety of *C. serrata*. *C. hirsuta*, King MS., is a scarce tree of the valleys of the Darjeeling Hills.

All the Cedrelas are handsome trees, with a red, rather soft wood, called "Red Cedar," having a pleasant scent, and well known as the usual wood for cigar-boxes. In the W. Indies, the wood is given by *C. odorata*, Linn., in the E. Indies by the species here described, while a similar wood is afforded in Australia by *C. australis*, F. von Muell.

Wood red, soft, durable, scented, easily worked. *Pores* moderate-sized, prominent on a vertical section. *Medullary rays* fine or moderately broad, evenly distributed but distant. *Annual rings* marked by a continuous belt of large pores.

1. **C. Toona**, Roxb.; Fl. Br. Ind. i. 568 (in part); Roxb. Fl. Ind. i. 635; Bedd. Fl. Sylv. t. 10; Brandis For. Fl. 72; Kurz For. Fl. i. 228; Gamble Darj. List 17; Talbot Bomb. List 43. The Toon tree or Red Cedar. Vern. *Tún, túni, lím, maha ním*, Hind.; *Túni, tún, lúd*, Beng.; *Maha limbu*, Uriya; *Mahlun*, Satpuras; *Drawi*, Pb.; *Túni, bobich*, Nep.; *Simal*, Lepcha; *Somso*, Bhutia; *Poma, henduri poma*, Ass.; *Goria ním*, Melghat; *Grawa*, Khond; *Mahalimo*, Saora; *Kujya*, Tippera; *Katangai*, Kól; *Madagiri vembu*, Madura; *Santhana vembu*, Tam.; *Mathagiri vembu*, Mal.; *Vedi vembu*, Trav. Hills; *Súli, máli*, Salem; *Kal kilingi*, Nilgiris; *Sandani vembu*, Tinnevelly; *Tundú, kempú gandagheri*, Kan.; *Nogé, belandi*, Coorg.; *Devdari, todu, mahaním, huruk, kúruk*, Mar.; *Chikado, tseetkado*, Magh; *Shurúzbed*, Chakma; *Thitkado*, Burm.

A large deciduous tree. *Bark* thin, dark grey-brown, exfoliating when old in irregular woody scales. *Wood* brick-red, soft, shining, even- but open-grained, fragrant, seasons readily, does not split or warp. *Annual rings* distinctly marked by a belt of large and numerous pores. *Pores* frequently double or subdivided, unequally distributed, scanty in the autumn wood, somewhat unequal in size, prominent on a vertical section; those in the spring wood larger. *Medullary rays* red, fine and moderately broad, uniform, bent round the pores; giving a marked silver-grain.

Forests of the sub-Himalayan tract and valleys in the North-West Himalaya up to 4000 ft., in the Punjab and eastwards, chiefly along streams, to Sikkim and Assam;

Eastern Bengal and Burma, less common; throughout Western and Southern India a low elevations; often planted in avenues and gardens.

The Toon tree is one of the most important of Indian trees, and is very largel cultivated, and almost everywhere where cultivated can extend itself by self-sowi seedlings.

Growth rapid: Brandis says that in 1863 he measured the following trees on th Eastern Jumna Canal near Saharanpur:—

Age 30 years, girth 58 inches, mean of 6 trees.
" 35 " " 86 " " 5 "

This would give a growth of 2½ to 3 rings per inch of radius, which is very fast The specimens show a growth varying from 3 to 9 rings per inch of radius, showin that some have come from fast-grown trees, while others have had only a moderat growth. The average measurements of 50 trees in the Kulsi Plantation in Assan gave for 22 years' age a height of 63 ft., girth 22 in., which is a growth of abou 6 rings per inch.

The weight and transverse strength have been determined by the followin experiments:—

Experiments by whom conducted.	Year.	Wood whence procured.	No. of experiments.	Size of bar.	Weight.	Value of P.
				ft. in. in.		
Clifford . . .	1862	Bengal	—	6 × 2 × 2	34	369
Campbell . . .	1831	Morung	1	6 × 2 × 2	35	423 (unseasoned
Kyd	1831	Assam	2	2 × 1 × 1	33	465
Cunningham . .	1854	Gwalior	2	2 × 1 × 1	34	541
Skinner, No. 45 .	1862	Travancore	—	—	31	560
Baker	1829	Chittagong	3	6 × 2 × 2	40	550
Fowke. . . .	1859	—	—	—	35	420
Brandis, No. 25 .	1862	Burma	—	—	28	—
R. Thompson . .	1868	Central Provinces	—	—	35	—
Wallich, Nos. 39 and 40	—	Assam and India	2	—	34	—
Hamilton . . .	—	—	—	—	36	—
Bourdillon . . .	1896	Travancore	—	—	29	349

Considering these experiments and the specimens here described, we may tak W = 35 and P = 465.

The wood is durable, and is not eaten by white ants; it is highly valued and universally used for furniture of all kinds, and is also employed for door panels and carving. From Burma it is exported under the name of "Moulmein Cedar," and a such is known in the English market. It there fetches about Rs.65 per ton, the cost of cutting and delivery being Rs.44, according to Col. Seaton. In North-West India it is used for furniture, carvings and other purposes. In Bengal and Assam it i the chief wood for making tea-boxes, but has got scarce on account of the heavy demand. It is also used for the purpose in Kangra. In South India it is very largely used for cigar-boxes. In Bengal, Assam and Burma it grows to a large size, trees 20 ft. girth with a height of 80 ft. of clear stem being not uncommon in forests which have been only little worked, like those in some parts of the Chittagong Hill Tracts. Though easily distinguished when growing from *C. microcarpa*, the woods are very similar, so that they are cut and used or exported indiscriminately.

An analysis of the wood shows that calcium carbonate is the principal ingredient of the ash. The leaves are used to feed cattle, and the flowers give a red or yellow dye (*Gulnari*). The bark is astringent, and gives a resinous gum; it is also used as a febrifuge.

The seed is very small and light, and runs about 1200 to the ounce. Seedlings are easily raised, but difficult to transplant. The roots are surface-feeders, so that it ought not to be grown on the edges of fields.

The Toon tree suffers considerably from an insect enemy, the "Toon twig-borer," a moth of the Family of the Phycitidæ, the *Magiria robusta*, Moore, which bores along the pith of the leading shoots, which are consequently destroyed, this destruction

seriously damaging the proper growth of the tree (see "Injurious Insects," by E. P. Stebbing, p. 122). The same borer attacks also the leading shoots of allied species, especially of mahogany (*Swietenia Mahagoni* and *macrophylla*). No remedy for the damage has yet been suggested, but in young plants the best thing is to cut and burn the young shoots directly the presence of the larva is ascertained from the appearance of the usual gummy exudation.

		lbs.
P 1191.	Madhopur, Punjab (F. Halsey)	35
H 8.	Simla, Punjab	37
H 5.	Sirmúr, Punjab	—
O 214.	Garhwal, 1868	36
C 177.	Mandla, C.P., 1871	37
C 3476.	Saranda Forests, Chota Nagpore (Gamble)	—
C 3545.	Khurdha Forests, Orissa (Gamble)	31
E 640.	Kamrúp, Assam (Mann) } some of	44
E 1266.	Tezpúr " " } these may	34
E 1229.	Sibságar " " } belong to	31
E 712.	Chittagong (Chester) } *C. microcarpa*	—
D 1054.	Salem, Madras (Beddome)	39
W 763.	South Kanara (Cherry)	29
W 4147.	Malabar	34
B 272.	Burma, 1867	35
B 803.	Tharrawaddi, Burma (Ribbentrop)	38
No. 18,	Salem Collection	35
No. 19,	" " (marked *Chickrassia tabularis*)	37

Nordlinger's Sections, vol. 4 (Tab. III. 5).

2. C. microcarpa, C. DC; Monog. Phan. i. 745. Vern. *Tún, túni,* Hind. (names much as in *C. Toona*).

A large evergreen tree. *Bark* dark brown, rough. *Wood* as in *C. Toona*, but pores rather smaller, and *medullary rays* finer and more clearly marked.

Hills of the Sikkim Himalaya at about 2–4000 ft.; hills of Eastern Bengal and Chittagong; hill forests of South India up to 5000 ft.

This is a larger tree than *C. Toona*, and affects the sides and slopes of valleys in the hill country. The wood is used for the same purposes as that of *C. Toona*. The growth is faster. It is, in all probability, the tree referred to by Mr. Graham Anderson ("Forest Trees in the Coffee Lands of S. Mysore," Bangalore, 1888) as "*Gund gerweygay*, '*gunda gerigay, nogwarra, nogga, chitkye, card bayew*, Kan.," and apparently considered an excellent shade tree for coffee.

		lbs.
E 655.	Bamunpokri, Darjeeling Terai (Manson)	30
E 2332.	Sukna, Darjeeling 2000 ft. (Gamble)	36
E 3599.	" " " "	39
E 3619.	Latpanchor, Darjeeling, 4000 ft. (Gamble)	—
E 3623.	Kalimpúng, Darjeeling, 2000 ft. "	35
B 5052.	Thongwa, Henzada, Burma (marked *Melia birmanica*)	37

In the Darjeeling Hills is another Toon, which Sir G. King also identifies as *C. microcarpa*, but which I cannot help thinking to be distinct. It grows into an enormous evergreen tree with reddish-brown bark, exfoliating in long flakes. The wood used to be largely in use for rice-pounders and for dug-out canoes, but the demand for tea-box wood has cleared off most of the large trees, so that it must now be scarce. In the "Ind. Forester," i. 91, the cubic contents of four trees in the Reyang Valley are given as 211, 375, 720 and 400 cub. ft. respectively, the largest having a mean girth of 12 ft. and a length of 80 ft. Its identity requires, I think, some further investigation. The wood is redder and softer than that of *C. Toona*.

		lbs.
E 860.	Tukdah, Darjeeling, 5000 ft. (Johnston)	34
E 2333.	Darjeeling, 6000 ft. (Gamble)	34

3. **C. multijuga,** Kurz For. Fl. i. 229. *C. Toona*, Roxb.; Fl. Br. Ind. i. 569 (in part). Vern. *Taungdama*, Burm.; *Nee*, Karen.

A large evergreen tree. *Wood* light, soft, pink, with structure like that of *C. Toona*, but pores more scanty.

Tropical forests of the Eastern slopes of the Pegu Yoma, west of Toungoo.

		lbs.
B 3378.	Salween Valley, Burma, 2000 ft.	36

4. **C. serrata,** Royle; Brandis For. Fl. 73; Kurz For. Fl. i. 229. *C. Toona*, Roxb.; Fl. Br. Ind. i. 568 (in part). Vern. *Drawi, dalli, dál, dauri, khishing, khinam, durla*, N.-W. Him.; *Soni*, Kumaon; *Darlú, darli, darloi*, Jaunsar.

A tree. *Bark* dark grey, ½ in. thick, with regular longitudinal furrows. Heartwood light-red, even- but open-grained, scent often unpleasant. *Annual rings* distinctly marked by broad belts of numerous large pores. *Pores* often double or divided into three compartments, very unequal in size from small to large, and unequally distributed, very prominent on a vertical section, scanty and small in autumn wood, large and very numerous in spring wood, usually filled with resin. *Medullary rays* fine and moderately broad, rather few, bent round the pores.

Western Himalaya up to 8000 ft., from the Indus to the Jumna.

The wood is at once distinguishable from that of *C. Toona* by the prevalence of very much larger pores and much more marked annual rings. In appearance the tree is also quite different; it has very long leaves, usually pink flowers, and the young trees spread like an umbrella; it has also different bark, and is always found at much higher elevations. In Ceylon it has been introduced as a shade tree for tea, and it is very largely planted for the same purpose over coffee in Java. In Jaunsar the wood has been used considerably in the building of forest houses, and for beams and sleepers on the sledge-roads, wet-slides and bridges. The growth is sometimes very fast, sometimes as fast as 2 rings to the inch of radius.

Average weight, 33 lbs. per cubic foot. The wood is used for many purposes about Simla, also for the hoops of sieves and for bridges. The shoots and leaves are lopped for cattle fodder.

		lbs.
H 3181.	Dúngagalli, Hazara, 6000 ft.	—
H 920.	Hazara, Punjab, 6000 ft. (Baden-Powell)	88
H 897.	Murree, Punjab, 7000 ft. „	29
H 782.	Salán, Chamba, 5000 ft. (Pengelly)	28
H 25.	Matiyáua, Simla, 7000 ft.	31
H 430.	Deoban Range, Jaunsar, 5500 ft. (Bagshawe)	30
H 4486.	Dehra Dún, 2300 ft. (cult.) (Gamble)	30
	Nordlinger's Sections, vol. 9 (Tab. III. 6).	

B 505, sent from the Andaman Islands under the name of *Diospyros undulata*, Vern. *Thikado*, Burm.; *Pádá*, And., has a reddish, moderately hard, even-grained *wood* which seasons well. *Pores* large, scanty, often subdivided; very prominent on a vertical section. *Medullary rays* numerous, fine, uniform; the distance between the rays many times less than the transverse diameter of the pores. It evidently belongs to Meliaceæ, but has not yet been identified.

21. CHLOROXYLON, DC.

1. **C. Swietenia,** DC; Fl. Br. Ind. i. 569; Bedd. Fl. Sylv. t. 11; Brandis For. Fl. 74; Talbot Bomb. List 43; Trimen Fl. Ceyl. i. 253. *Swietenia Chloroxylon*, Roxb. Fl. Ind. ii. 400. Satin wood. Vern. *Behra, girya, behru, bihri*, C.P.; *Bhirra, girya*, Berar; *Bhira*, Gondi; *Bhirwa*, Baigas; *Bella*, Palkonda; *Halda, bheria, billu*, Mar.; *Múdúdad, mutirai, burús, purúsh*, Tam.; *Billu, bilgu*, Tel.; *Sengel, sali*, Kól; *Bharhul*, Kharwar; *Behru*, Uriya; *Huragalu*, Mysore; *Buruta*, Cingh.

A moderate-sized deciduous tree. *Bark* ⅓ in. thick, soft, spongy, light grey or yellow. *Wood* very hard, yellow or cream-coloured, the inner wood darker than the outer, but no distinct heartwood; having a fine satiny lustre. *Annual rings* distinct. *Pores* very small, evenly distributed, single or in short radial lines, between the fine uniform and equidistant, very short *medullary rays*, which are visible on a radial section as small shining plates which cause the beautiful silver-grain.

Central and Southern India and Ceylon. It commences in the Satpura Range, and is found in dry forests through the Circars, the Konkan, the Deccan and Carnatic, especially on rather poor soils, as on sand and laterite. The finest I have seen were in the Gumsúr and Surada Forests of the N. Circars. In Ceylon (see A. F. Broun, "Ind. For.," xxv. 181, with map) it affects the dry regions of the north and east, the finest forests being those about Puttalam and Batticaloa.

This beautiful tree gives the satinwood of commerce, which is largely exported from Ceylon, and, to a much less extent, from India. It is much used for cabinet work and the backs of brushes, also for pretty furniture and picture-frames. Locally it has been used for building, for carts and agricultural implements. It has been tried as a substitute for boxwood for engraving, but not very successfully. Sleepers made of it have lasted for 20 years on the Ceylon Railway; and so far the experiments as to its behaviour in sea-water point to its resisting teredo. A celebrated bridge at Peradeniya, near Kandy, with a single arch of 205 ft. span, was built entirely of it. "Figury" wood fetches a good price, reaching as much as Rs.7 per cubic foot in Colombo, ordinary wood being valued at about Rs.2½. Logs sometimes run to a girth of 8 to 9 ft.

The cause of "figury" wood has been somewhat discussed, but scarcely yet satisfactorily determined. Mr. H. S. Hansard in "Ceylon Forester," ii. 253, maintains that it is caused by irregular growth from the cambium; Mr. Armitage in the same paper, that it is caused by the irregular healing of wounds in the bark made by the sambhar deer.

The data regarding rate of growth are not very good. Broun, however, gives 20 years as the time in which a tree reaches 18 in. girth, 45 years for 36 ins., 75 years for 54 in., and 125 years for 72 in. He seems to consider that 6 ft. is the best exploitable size, but in India I suspect that trees of that size would be long over-mature and probably hollow.

The following experiments have been made to determine the weight and transverse strength:—

Experiment by whom conducted.	Year.	Wood whence procured.	No. of experiments.	Size of bar.	Weight.	Value of P.	Remarks.
				ft. in. in.	lbs.		
Baker	1829	Madras	3	6 × 2 × 2	65	744	
A. Mendis	1855	Ceylon	2	2 × 1 × 1	56	1042 / 504	Nos. 8, 52
Skinner	1862	Madras	1	—	60	870	No. 47
Puckle	—	W. Mysore	3	2 × 1 × 1	—	812	Balfour, p. 317
Paris Exh. Cat.	1862	C.P.	—	3 × 1½ × 1½	61	620 to 1059	
Wallich	—	Ceylon	—	—	51	—	No. 187
Molesworth	—	"	—	—	60	950	E = 5200
H. H. O'Connell	1886	Tinnevelly	—	—	61	—	a = 0·00699
The specimens	1899	Various places	—	—	59	—	
Broun	—	Ceylon	12	—	60	1000	

I am inclined to agree with Broun that P = 1000 is perhaps the best to take. His weight of 60 lbs. is probably also correct.

The experiments made by Prof. W. C. Unwin, F.R.S., for the Imperial Institute, on Ceylon woods, gave the following results (*Imp. Inst. Journ.*, May, 1899):-

Weight	64·32 lbs. per cubic foot.
Resistance to shearing along the fibres	1903 lbs. per square inch.
Crushing stress	3·374 tons per square inch.
Coefficient of transverse strength	6·150 " "
Coefficient of elasticity	699 " "

Broun describes the tree as a "shade-avoiding" tree, requiring, however, some low cover when young. It comes up readily in clearings and on the sides of forest roads, and he considers the reproduction good.

	lbs.
C 1153. Ahiri, C.P. (R. Thompson)	54
C 1412. Seoni, C.P.	49
C 2742. Jamui, Berar (Brandis)	52
C 1239, 1304. Gumsúr, N. Circars (Dampier)	56
C 3443. Seemah Forest, Palamow (Gamble)	—
C 3572. Khurdha Forests, Orissa "	57
C 3823. Kurcholy Forests, Ganjam (Gamble)	56
C 3943, 4065. Rekapalle Forests, U. Godavari (Gamble)	65
D 2926. Madras	—
D 1069. N. Arcot (Beddome)	61
D 4448. South Arcot (Wooldridge)	—
No. 20, Salem Collection	61
Nos. 8, 52, Ceylon Collection, old; Nos. 14, 90, new (Mendis)	56

Nordlinger's Sections, vol. 11.

ORDER XXX. CHAILLETIACEÆ.

1. CHAILLETIA, DC.

Three species. *C. Helferiana*, Kurz For. Fl. i. 230; Fl. Br. Ind. i. 570, and *C. longipetala*, Turcz.; Fl. Br. Ind. i. 571 (*C. macropetala*, Kurz For. Fl. i. 231), are evergreen shrubs or trees found in Tenasserim.

1. C. gelonioides, Hook. f.; Fl. Br. Ind. i. 570; Bedd. Fl. Sylv. lix.; Kurz For. Fl. i. 230; Talbot Bomb. List 43. *C. sumatrana*, Miq.; Trimen Fl. Ceyl. i. 254. *Moacurra gelonioides*, Roxb. Fl. Ind. ii. 69. Vern. *Moakurra*, Beng.; *Baluna kuta*, Cingh.

A small evergreen tree. *Bark* thin, light yellowish-brown, with prominent rough lenticels in horizontal lines. *Wood* light yellowish-brown, moderately hard. *Pores* small, rather scanty, the *annual rings* marked by the absence of pores in the spring wood. *Medullary rays* variable, fine to broad, often short, several fine rays between the broad ones; silver-grain of whitish plates.

Khasia Hills and Sylhet; Chittagong; Western Ghâts (common in N. Kanara near the falls of Gairsoppa); Ceylon, in the moist low country, up to 3000 ft.

The wood somewhat resembles that of the oaks, especially that of the first-mentioned specimen, which is clearly from an older tree than the other.

East Indies—Kew Museum (J. D. Hooker).
Khasia Hills, 2–3000 ft.—Kew Museum (J. D. Hooker).

ORDER XXXI. OLACINEÆ.

An Order of very small forest importance, but still containing about 20 genera of trees, shrubs or climbers, found in the forests of India. They are chiefly found in the moist zones of the forests of Bengal, Burma, the Western Ghâts and Ceylon, and none of them are particularly common. A few genera afford large trees, but none of them have timbers of any importance.

The Order is divided into four Tribes, viz.—

Tribe I. Olaceæ	Ximenia, Olax, Erythropalum, Strombosia, Anacolosa, Schöpfia.
„ II. Opilieæ	Cansjera, Natsiatopsis, Lepionurus, Opilia.
„ III. Icacineæ	Lasianthera, Gomphandra, Apodytes, Mappia, Phlebocalymna.
„ IV. Phytocreneæ	Phytocrene, Miquelia, Sarcostigma, Natsiatum, Iodes.

1. XIMENIA, Linn.

1. X. americana, Willd.; Fl. Br. Ind. i. 574; Roxb. Fl. Ind. ii. 252; Kurz For. Fl. i. 232; Talbot Bomb. List 44; Trimen Fl. Ceyl. i. 255. Vern. *Uranechra*, Tel.; *Kakira*, Rumpa; *Chiru-illantai*, Tam.; *Pinlè kayin, pinlèzi*, Burm.

A large shrub. *Bark* dark reddish-brown, very rough with deep fissures, ¼ in. thick. *Wood* yellowish-red, hard, heavy, close-grained. *Pores* small, evenly distributed, less numerous in the autumn wood. *Medullary rays* very fine, short.

Dry forests of the Deccan, on stony ground; Trincomali and Batticaloa in Ceylon, scarce; rocky coast of the Andaman Islands.

A thorny shrub with bright-orange edible fruit. The kernels of the fruit are also eaten, and taste like filberts. The wood is used as a substitute for sandal by Brahmins on the East Coast in their religious ceremonies (Roxb.).

		lbs.
C 3920.	Peddapuram Forests, Upper Godavari (Gamble)	—
D 3986.	Ballipalle Forest, Cuddapah „	67

2. OLAX, Linn.

Seven species, mostly scandent shrubs. *O. Wightiana*, Wall.; Fl. Br. Ind. i. 575; Bedd. Fl. Sylv. lx.; Talbot Bomb. List 44; Trimen Fl. Ceyl. i. 256, is a large climbing shrub or small tree (Bedd.) of S. India and Ceylon. *O. merguensis*, Planch.; Fl. Br. Ind. i. 576 is a low tree of the Margui District of Tenasserim. *O. nana*, Wall. is a small undershrub of the plains and lower hill forests of the North-West Provinces up to 5000 ft., common in the Oudh forests. *O. acuminata*, Wall. is a climbing shrub of Assam, the Khasia Hills, Sylhet, and the Kachin Hills of Burma; and *O. imbricata*, Roxb., a similar shrub of Chittagong and Tenasserim.

1. O. scandens, Roxb. Fl. Ind. i. 163; Fl. Br. Ind. i. 575; Brandis For. Fl. 75; Kurz For. Fl. i. 233; Talbot Bomb. List 44; Trimen Fl. Ceyl. i. 256. Vern. *Dheniani*, Hind.; *Koko-aru*, Beng.; *Arthil*, Monghyr; *Rimmel*, Kól; *Bodobodoria*, Uriya; *Ehir*, Sonthal; *Mudalkura*, Khond; *Kadalranchi*, Tam.; *Kurpodur, murki malle, turkavepa*, Tel.; *Harduli, urchirri*, Mar.; *Lèlu*, Burm.

A large rambling shrub, sometimes a climber. *Bark* grey, ½ in. thick, deeply cleft vertically. *Wood* porous, yellowish-white, soft. *Pores* numerous, large and moderate-sized, uniformly distributed, often oval. *Medullary rays* fine, numerous, not prominent.

Sub-Himalayan tract in Kumaon; Behar; Central and South India; Burma, extending to the Shan Hills.

This is a destructive climber, doing considerable damage to forest trees. It is chiefly found on wet ground near rivers and in ravines. The fruit is used in Hazáribágh for making sherbet.

		lbs.
C 1184.	Ahiri Reserve, Central Provinces (R. Thompson)	40
C 2762.	Moharli " " " (Brandis)	36
C 3820.	Surada Forests Ganjam (Gamble)	—
C 3467.	Baudgaon, Singbhúm "	—
C 3494.	Kolhán Forests, Singbhúm "	—

2. O. zeylanica, Linn.; Fl. Br. Ind. i. 576; Bedd. Fl. Sylv. lx.; Kurz For. Fl. i. 233; Trimen Fl. Ceyl. i. 257. Vern. *Mélla*, Cingh.

A small tree with angled branches. *Wood* yellowish-white, hard, close- and even-grained, resembling boxwood. *Pores* small, in narrow rings of light tissue and roughly in concentric lines. *Medullary rays* fine, regular, prominent.

Upper Burma (Kurz); moist low country of Ceylon.
The leaves are eaten in salad and curries.

Ceylon—Kew Museum (S. Jayateleke).

3. ERYTHROPALUM, Bl. Three climbing shrubs. *E. scandens*, Bl. occurs in Eastern Bengal and Burma; *E. vagum*, Mast., in the Sikkim Himalaya and Assam; and *E. populifolium*, Mast., in Travancore.

4. STROMBOSIA, Bl. Three large trees. *S. javanica*, Bl.; Fl. Br. Ind. i. 579; Kurz. For. Fl. i. 235, is a lofty tree of Tenasserim, said to have a hard white wood. *S. ceylanica*, Gardn.; Fl. Br. Ind. i. 579; Bedd. Fl. Sylv. t. 137; Talbot Bomb. List 45; Trimen Fl. Ceyl. i. 257, is a large tree of the Western Ghâts, in the Konkan and Kanara, also in Ceylon. Trimen says the wood is "moderately heavy, rather soft, pale yellowish-brown, shining." *S. leprosa*, Talbot in Journ. Bomb. N. H. Soc. xi. 235 (*S. ceylanica*, Gardn.; Fl. Br. Ind. i. 579 (in part)), is a large tree of the forests of N. Kanara.

5. ANACOLOSA, Bl.

Four species. *A. ilicoides*, Mast. in Fl. Br. Ind. i. 580, is a small spreading tree of the Khasia Hills. *A. Griffithii*, Mast.; Kurz For. Fl. i. 236, is an evergreen shrub of Tenasserim, and *A. puberula*, Kurz, a large shrub of the Andaman Islands.

1. A. densiflora, Bedd. Fl. Sylv. t. 138; Fl. Br. Ind. i. 580.

A large tree. *Wood* light reddish-brown, moderately hard. *Pores* moderate-sized, in radial or slightly oblique strings. *Medullary rays* very fine, very numerous, the distance between them much less than the diameter of the pores. Cells large and prominent under the lens on a cross-section.

Anamalai Hills of Coimbatore at 2000 ft.; hills of Travancore.

		lbs.
W 4679.	Travancore (Bourdillon)	50

6. SCHŒPFIA, Schreb.

S. fragrans, Wall.; Fl. Br. Ind. i. 581, is a small tree of Nepal, the Khasia Hills, and the Kachin Hills of Upper Burma.

1. S. acuminata, Wall.; Fl. Br. Ind. i. 582.

A tree. *Wood* yellowish-white, soft, with narrow, irregular, broken or anastomozing bands of soft texture. *Pores* small, often subdivided, scanty; usually but not always in the soft bands. *Medullary rays* fine, not numerous, wavy.

Mishmi Hills, Khasia Hills and Sylhet.
Khasia Hills—Kew Museum (J. D. Hooker).

7. CANSJERA, Juss.

Three species, two of which are climbing shrubs of the Burmese forests, of little importance.

1. **C. Rheedii,** Gmelin; Fl. Br. Ind. i. 582; Brandis For. Fl. 75; Bedd. Fl. Sylv. clxxix.; Kurz For. Fl. i. 237; Talbot Bomb. List 45; Trimen Fl. Ceyl. i. 259. *C. scandens*, Roxb. Fl. Ind. i. 441. Vern. *Pita-bodalya*, Uriya; *Eta-mura*, Cingh.

A large evergreen climbing shrub. *Bark* cream-coloured, somewhat corky. *Wood* yellowish-white. *Pores* small, rather scanty. *Medullary rays* fine, white, short, moderately numerous. *Annual rings* distinct.

Forests of Oudh, South India, Burma and Ceylon.

C 3946. Rekapalle Forests, U. Godavari (Gamble).
C 4321. Juddengy Forests, Godavari „

8. NATSIATOPSIS, Kurz. *N. thunbergiæfolia*, Kurz For. Fl. i. 237, is a climbing shrub of Upper Burma.

9. LEPIONURUS, Blume. *L. oblongifolius*, Mast. in Fl. Br. Ind. i. 583; Gamble Darj. List 17 (*L. sylvestris*, Kurz For. Fl. ii. 330), is a small tree of the North-East Himalaya and Eastern Bengal.

10. OPILIA, Roxb. *O. amentacea*, Roxb. Fl. Ind. ii. 87; Fl. Br. Ind. i. 583; Bedd. Fl. Sylv. lx.; Trimen Fl. Ceyl. i. 258; Vern. *Baleekoma*, Tel., is a scandent shrub or small tree of South India and Burma.

11. LASIANTHERA, Pal. de Beauv.

1. **L. apicalis,** Thw.; Fl. Br. Ind. i. 584; Bedd. Fl. Sylv. t. 139; Trimen Fl. Ceyl. i. 260. Vern. *Urukanu, uruhonda*, Cingh.

A moderate-sized or large pyramidal tree. *Bark* smooth. *Wood* greyish- or yellowish-brown, soft to moderately hard. *Pores* small, evenly distributed, usually in patches of soft light tissue. *Medullary rays* fine, short, numerous, with occasional broad ones; silver-grain very prominent, speckled, in small oblique patches.

Moist low country of Ceylon, up to 2000 ft.
Mendis says the wood is used for building and for coffee and plumbago casks.

No. 140, Ceylon Collection, new (Mendis).
Ceylon: Int. Exhn., 1862—Kew Museum.

12. GOMPHANDRA, Wall.

Five species. Besides the two described, there are three species, all trees, given in Kurz' "Forest Flora" under the generic name of *Stemonurus*, Bl., as found in Burma.

1. **G. polymorpha,** Wight; Fl. Br. Ind. i. 586. *G. coriacea*, Wight; Bedd. Fl. Sylv. lxi.; Trimen Fl. Ceyl. i. 261.

A small tree. *Bark* thin, light greyish-brown, smooth. *Wood* greyish-white, soft. *Pores* small, scanty. *Medullary rays* broad, white, showing a good silver-grain. Very many fine, white, irregular and wavy transverse bars.

Hills of South India and Ceylon, above 6000 ft.; common in the underwood in thick Nilgiri sholas.

		lbs.
W 3816.	Lamb's rock shola, Nilgiris, 5000 ft. (Gamble)	40

2. G. axillaris, Wall.; Fl. Br. Ind. i. 586; Bedd. Fl. Sylv. lxi.; Talbot Bomb. List 45; Trimen Fl. Ceyl. i. 261.

Wood grey, similar to that of *G. polymorpha.*

Forests of Sylhet; Western Ghâts from Konkan and N. Kanara to Travancore, up to 4000 ft.

A small tree of forest undergrowth at lower levels than *G. polymorpha.* Bourdillon gives W = 30 lbs., P = 358.

		lbs.
W 4619.	Travancore (Bourdillon)	31

13. APODYTES, E. Meyer. Four species. *A. Benthamiana,* Wight; Fl. Br. Ind. i. 588; Bedd. Fl. Sylv. t. 140, var. *α*, is a tree of the hills of South India, at 5–7000 ft. *A. Gardneriana,* Miers; Trimen Fl. Ceyl. i. 262, is a tree of the hill region of Ceylon up to 6000 ft. *A. Beddomei,* Mast. in Fl. Br. Ind. i. 588; Bedd. Fl. Sylv. t. 140, var. *β*, is a tree of the Nilgiri northern slopes and the hills of Travancore. *A. andamanica,* Kurz For. Fl. i. 239, is an evergreen tree of the Andaman Islands.

14. MAPPIA, Jacq.

Four species. *M. tomentosa,* Miers; Fl. Br. Ind. i. 589, like *M. fœtida,* Miers, is a common tree of the Nilgiri sholas, up to 7000 ft. *M. ovata,* Miers; Fl. Br. Ind. 589; Trimen Fl. Ceyl. i. 262; Vern. *Gandapana,* Cingh., is a tree of South India and Ceylon at rather lower levels than the other two. *M. oblonga,* Miers; Fl. Br. Ind. i. 589; Talbot Bomb. List 45; Vern. *Gár, kalgúr,* Mar.; *Chorla, pilipiccha,* Trav. Hills, is a tree of the Western Ghâts in the Konkan and N. Kanara, having, like most of the species, flowers with a very strong unpleasant smell.

1. M. fœtida, Miers; Fl. Br. Ind. i. 589; Bedd. Fl. Sylv. t. 141 (not the text). Vern. *Aráli,* Tam.

A tree. *Bark* greenish-grey, rough. *Wood* white or greyish, soft. *Pores* moderate-sized to large, scanty, in radial strings. *Medullary rays* numerous, broad, prominent in the silver-grain. Cells easily seen under the lens.

Nilgiri Hills at 5–7000 ft.; hills of Mysore.

		lbs.
W 4036.	Cairn Hill, Ootacamund, 7000 ft. (Gamble)	32

15. PHLEBOCALYMNA, Griff. Three species, shrubs or small trees of Burma. *P. Griffithiana,* Mast.; Fl. Br. Ind. i. 590 (*Gonocaryum Griffithianum,* Kurz For. Fl. i. 241), is an evergreen tree of the swamp forests of Burma.

16. PHYTOCRENE, Wall.; *P. gigantea,* Wall.; Fl. Br. Ind. i. 591; Kurz For. Fl. i. 241, is a gigantic climber of the forests of Chittagong and Burma, whose stem on being cut gives out a quantity of fresh water good to drink. The wood has "very large porous vessels and thick medullary rays, but no annual rings" (Fl. Br. Ind.).

I have not seen any specimen of the wood of *P. gigantea,* but there are good representatives of those of *P. bracteata,* Wall., and *P. palmata,* Wall., both Malay species, in the Kew Museum. In the former there is a large central pith with a few small fibro-vascular bundles arranged radially round the outer edge. Then comes a ring of very porous wood with large radially arranged oblong blunt wedges about 9 to 10 in number, the outer part of which is bast tissue, the inner wood tissue with a few large pores. Then comes a bast ring, and then further wood rings of similar character. In the latter there is a small ring of central pith, followed by starlike irregular patches of wood tissue set in bast, then irregular scattered but more or less concentric

patches of large-pored wood tissue. In both the bark is dark coloured, rough, somewhat leathery. There is also a drawing of the wood of *P. gigantea*, with a drawing of a section of a young stem in Wallich Pl. As. Rar. t. 215, which shows a central pith with short broad medullary rays radiating from it and surrounded by tissue with very large and large pores. This is followed by a ring of tissue without pores, and this again by another similar ring of pores and medullary rays, and so on.

17. MIQUELIA, Meissn. Two climbing shrubs: *M. Kleinii*, Meissn., of Assam; and *M. dentata*, Bedd., of the Anamalai Hills.

18. SARCOSTIGMA, W. and A. Three climbing shrubs, one Burmese (*S. Wallichii*, Baill.), one of the Andamans (*S. edule*, Kurz), and the third (*S. Kleinii*, W. and A.) of West and South India.

19. NATSIATUM, Ham. *N. herpeticum*, Ham.; Fl. Br. Ind. i. 595; Kurz For. Fl. i. 242; Gamble Darj. List 17; Vern. *Sungoo-rik*, Lepcha, is a common climber of Northern and Eastern Bengal and Burma.

20. IODES, Blume. About four species, evergreen climbers of Eastern Bengal and Burma.

ORDER XXXII. **ILICINEÆ.**

One genus, Ilex, the Holly. Most of the hollies are found in hill regions.

1. ILEX, Linn.

About 23 Indian species. Three species are found in the Western Himalaya; eight in the Eastern Himalaya; seven in Assam and the Khasia Hills; four in Burma; five in South India, and three in Ceylon. Watt mentions also some new species from Manipur. *I. excelsa*, Wall.; Fl. Br. Ind. i. 603 (*I. exsulca*, Brandis For. Fl. 76); Vern. *Katonj*, Kumaon, is a small tree of the Himalaya from the Tons river (collected at Moragadh above Thadiar) eastwards, up to 6000 ft., Assam and the Khasia Hills, nowhere very common, and preferring shady underwood near streams. This with Nos. 2 and 3 are the species of the Western Himalaya. In the Eastern Himalaya are found Nos. 1, 2, 4 and 7, with *I. excelsa*, also *I. intricata*, Hook. f.; Fl. Br. Ind. i. 602, a straggling shrub of high elevations (10–11,000 ft.) in the Sikkim Himalaya; *I. fragilis*, Hook. f.; Fl. Br. Ind. i. 602; Gamble Darj. List 18, a small tree found in the Sikkim and Bhutan Himalaya at 7–10,000 ft., and in the Khasia Hills; and *I. Godajam*, Colebr.; Fl. Br. Ind. i. 604; Gamble Darj. List 18; Vern. *Tirsam*, Ass., a small tree found in the Darjeeling Terai and Western Dúars, extending to Assam and Sylhet. *I. theæfolia*, Wall.; *I. embelioides*, Hook. f.; *I. Griffithii*, Hook. f.; *I. Thomsoni*, Hook. f. and *I. venulosa*, Hook. f., are trees or shrubs of Assam and the Khasia Hills. *I. sulcata*, Wall.; *I. macrophylla*, Wall.; *I. cymosa*, Bl. and *I. Wallichii*, Hook. f., are trees of Burma, also *I. theæfolia*, Wall. (*I. gaultheriæfolia*, Kurz For. Fl. i. 245), before mentioned. *I. malabarica*, Bedd. Fl. Sylv. t. 143; Fl. Br. Ind. i. 600; Talbot Bomb. List 46, is a large tree of the Gháts of the Konkan and N. Kanara and of the Benné Forest in S.-E. Wynaad. *I. Gardneriana*, Wight; Fl. Br. Ind. i. 603; Bedd. Fl. Sylv. lxii., is a small tree or large shrub of the Western sholas of the Nilgiri plateau. *I. Walkeri*, Wight and Gardn.; Fl. Br. Ind. i. 600; Bedd. Fl. Sylv. lxii.; Trimen Fl. Ceyl. i. 264, is a small thickly branched tree found in the Pulney Hills in the Madura district and in the higher forests of Ceylon at 5–8000 ft. The European holly is *I. Aquifolium*, L., while the Maté or Paraguay tea is made from the leaves of *I. paraguayensis*, St. Hil.

Wood white or grey. *Pores* small, arranged in radial lines or irregular elongated patches of loose texture. *Medullary rays* of two classes, very fine and broad, the latter prominent on a vertical section, and causing a marked silver-grain.

1. I. insignis, Hook. f.; Fl. Br. Ind. i. 599; Gamble Darj. List 18. Vern. *Lasuni*, Nep.

A small evergreen tree. *Bark* smooth, grey. *Wood* white, soft, close-grained. *Annual rings* marked by a white line. *Pores* very small, numerous, often in radial lines, several such lines between each pair of broad medullary rays. *Medullary rays* very fine and broad, prominent on a radial section, giving the wood a fine silver-grain. *Medullary patches* often prominent.

Hills of Darjeeling, above 6000 ft.

In winter this tree has clusters of bright red berries like those of the common holly, and is used for similar purposes of decoration. Growth about 5 rings per inch of radius.

		lbs.
E 355.	Gumpahar Forest, Darjeeling, 7000 ft. (Johnston)	40
E 3407.	The Park, Darjeeling, 7000 ft. (Gamble).	41

2. I. dipyrena, Wall.; Fl. Br. Ind. i. 599; Brandis For. Fl. 76, t. 15; Gamble Darj. List 18. Vern. *Shangala, kandlar, kalúcho, diúsa, dodru, drúnda, kanjlu*, Pb.; *Kanderu*, Jaunsar; *Kandailo banj, kantal*, Kumaon; *Gardár*, Garhwal; *Thinkiyo, ilso*, Dotiál; *Kaula, karupui, munasi, gulsima*, Nep.; *Kandara, kaderu, kateru*, Simla.

A small evergreen tree. *Bark* light grey, sometimes nearly white, thin, smooth or slightly wrinkled. *Wood* white, hard, close-grained. *Pores* extremely small, in long irregular wavy radial lines, in patches of loose texture. *Medullary rays* of two classes, very fine and moderately broad, the latter darker than the cellular tissue, prominent on a radial section, giving the wood a pretty silver-grain.

Himalaya, from the Indus to Bhutan, above 5000 ft.

In the North-West Himalaya this holly is chiefly found in ravines and valleys, and sometimes attains a large size—witness the one near Naini Tál, recorded by Madden and mentioned by Brandis as having 16 to 17 ft. in girth.

		lbs.
H 21.	Matiyána, Simla, 7000 ft.	46
H 4765.	Deota, Tehri-Garhwal, 9000 ft. (Gamble)	44

3. I. odorata, Ham.; Fl. Br. Ind. i. 599; Brandis For. Fl. 77. Vern. *Garshún, garkaula, gadkanira, gadmel*, Kumaon; *Gadgair, gadáru*, Garhwal; *Són*, Dotial.

An evergreen tree. *Wood* greyish-white, structure similar to that of *I. insignis*.

Himalaya, from the Sutlej to Sikkim, up to 6000 ft.

		lbs.
H 256.	Garhwal Hills (R. Thompson)	32

4. I. sikkimensis, King Journ. As. Soc. Beng. lv. ii. 265. Vern. *Harré*, Nep.

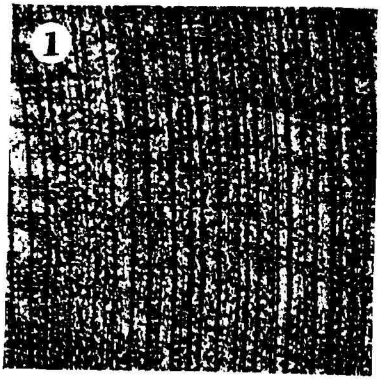
A moderate-sized evergreen tree. *Wood* white, soft, close-grained, with white concentric lines, which seem to correspond to annual rings. *Pores* very small and numerous. *Medullary rays* very fine and broad; the latter prominent, giving the wood a reticulate silver-grain.

Darjeeling Hills at 6–10,000 ft., common on Senchul.

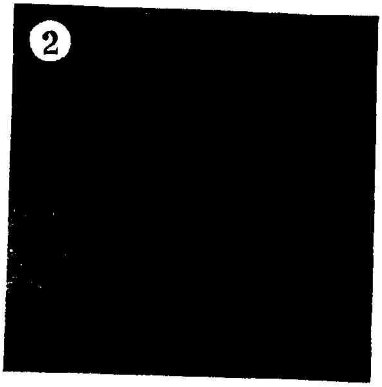
		lbs.
E 692.	Chuttockpur, Darjeeling, 6000 ft. (Johnston)	39

Nordlinger's Sections, vol. 10 (*I. theæfolia*) (Tab. IV. 1).

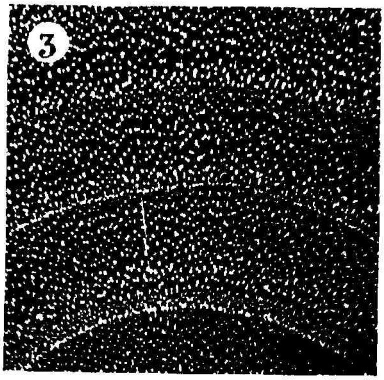
IV.



ILEX SIKKIMENSIS.



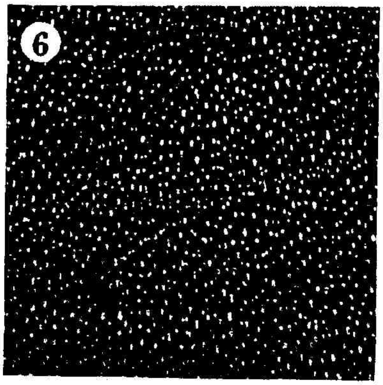
EUONYMUS LACERUS.



ZIZYPHUS JUJUBA.

RHAMNUS TRIQUETER.

SAPINDUS DETERGENS.



SCHLEICHERA TRIJUGA.

(Magnified 3½ times.)

5. **I. denticulata,** Wall.; Fl. Br. Ind. i. 600; Bedd. Fl. Sylv. t. 142; Trimen Fl. Ceyl. i. 265.

A large tree. *Bark* ½ in. thick, grey, somewhat rough. *Wood* grey, soft, warps somewhat. *Pores* very small, in long radial lines, between the fine *medullary rays*, several of which come between the moderately-broad rather dark-coloured ones, which give a pretty mottled silver-grain on a radial section.

Hills of S. India, common in the sholas of the Nilgiris and Anamalais at 6–8000 ft.; scarce in the Ceylon hills, though found about Newera Ellia.

Beddome says the timber is much valued and said not to warp or crack, but it is not held in much esteem on the Nilgiris, and the specimens warped a good deal.

		lbs.
W 4050.	Cairn Hill, Nilgiris, 7000 ft. (Gamble)	31
W 4094.	Lovedale, Ootacamund (Gamble)	40

6. **I. Wightiana,** Wall.; Fl. Br. Ind. i. 603; Bedd. Fl. Sylv. lxii.; Trimen Fl. Ceyl. i. 265. Vern. *Horralu,* Badaga; *Velloday,* Tam.; *Andun-wenna,* Cingh.

A large tree. *Bark* ½ in. thick, smooth, greyish-white. *Wood* greyish-white, soft. *Pores* very small, numerous, in radial lines, often 6 or 7 between each pair of fine medullary rays. *Medullary rays* long, fine and broad, dark, the broad ones on a radial section giving a silver-grain of curved lines and dots, and on a tangential section a speckled grain.

Hills of S. India, very common in Nilgiri sholas, also found in the Pulney, Anamalai and Travancore Hills, all at 6–8000 ft.; hills of Ceylon, but scarce.

A pretty tree with white flowers and clusters of red berries, one of the most noticeable of Nilgiri shola trees. Beddome says the wood is useful for building purposes, bowls, platters, etc. If carefully seasoned it would make a pretty wood for cabinet work on account of its marked silver-grain.

		lbs.
W 3874.	Ootacamund, Nilgiris, 7000 ft. (Gamble)	35
W 3749.	Coonoor, Nilgiris, 6000 ft. (Gamble)	40

7. **I. Hookeri,** King in Journ. As. Soc. Beng. lv. ii. 265. Vern. *Lisay,* Nep.

A small tree. *Bark* grey, ⅛ in. thick, somewhat rough. *Wood* very white, close- and even-grained. *Pores* very small, in irregular more or less zigzag patches of loose texture. *Medullary rays* of two kinds, very fine and broad, numerous. Structure much resembling that of *I. dipyrena.*

Higher Sikkim Himalaya at 9–10,000 ft., common on Mount Tonglo.

		lbs.
E 5087.	Darjeeling Hills, 9–10,000 ft. (C. G. Rogers)	50

Ilex Aquifolium, L., the European holly, is occasionally cultivated in the Indian hill stations. The *wood* is "heavy, hard, homogeneous, with a fine silver-grain; it 'has a very dominant fibrous tissue. The *medullary rays* are few, moderately broad, 'and between them are a number of very fine rays. *Pores* very small, not numerous, 'equal, some forming a ring at the beginning of each annual layer, and others grouped 'in series of 5 to 12 between the fine medullary rays" (Mathieu Fl. For. 58).

ORDER XXXIII. CELASTRINEÆ.

An Order of trees, shrubs and climbers, sometimes thorny, and recognized by the flowers having a conspicuous disc. It contains 12 genera, four of which are found in North-West India, and the remainder in the Eastern and Western moist zones.

The Order is divided into two Tribes, the first being subdivided into three. These are—

Tribe I. Celastreæ
Sub-tribe I. Euonymeæ . . . . Euonymus, Glyptopetalum, Microtropis, Lophopetalum, Kokoona, Pleurostylia.
„ II. Celastreæ . . . . Celastrus, Kurrimia.
„ III. Elæodendreæ . . . Elæodendron.
„ II. Hippocrateæ . . . . . . Hippocratea, Salacia, Siphonodon.

Elæodendron, *Pleurostylia*, *Lophopetalum*, *Kokoona*, *Kurrimia*, *Siphonodon* give trees of more or less forest importance and (some of them) useful woods. *Euonymus* woods are used in the hill regions for utensils and other carved work, and some species of *Celastrus* are of similar value in the plains.

Wood even-grained, hard, white or light brown; generally without heartwood. *Pores* uniformly distributed, very or extremely small. *Medullary rays* very fine, very numerous. Many genera have concentric bands of different colours. The climbing species have a different wood-structure.

1. EUONYMUS, Linn.

A genus of about 27 species, of which some are merely small shrubs or climbers. Five are found in the Western Himalaya, six in the Eastern, four in Assam and Eastern Bengal, four in Burma, six in South India and three in Ceylon. Few are of any importance, but most of the tree species have an even-grained white wood, useful for turning.

E. bullatus, Wall.; Fl. Br. Ind. i. 610; Gamble Darj. List 18, is a small tree of the lower Darjeeling Hills and of the Khasia Hills up to 4000 ft. *E. glaber*, Roxb. Fl. Ind. i. 628; Fl. Br. Ind. i. 609; Kurz For. Fl. i. 248, is an evergreen tree of Chittagong and Burma, extending to the Shan Hills, and said by Kurz to have a yellowish-brown wood, heavy, close-grained, useful for furniture. *E. javanicus*, Bl.; Kurz For. Fl. i. 249, is an evergreen tree of the forests of Tenasserim. *E. indicus*, Heyne; Fl. Br. Ind. i. 608; Talbot Bomb. List 47 (*E. Goughii*, Bedd. Fl. Sylv. lxiii.), is a tree of the evergreen forests of the Konkan and N. Kanara, S. Kanara and Coorg. *E. dichotomus*, Heyne; Bedd. Fl. Sylv. lxiii., is an evergreen tree of the higher hills of S. India, common on the Anamalais up to 4500 ft. *E. echinatus*, Wall.; Brandis For. Fl. 80; Gamble Darj. List 18; Vern. *Sanu kimú*, Nep.; *Palo*, Kumaon; *Ladúli*, Garhwal, is an ivy-like shrub of the Himalaya from the Jhelum to Sikkim at 7–10,000 ft., common at Deoban and about Darjeeling, growing over rocks. The "Spindle tree" of Europe is *E. europœus*, Linn., the wood of which, carefully carbonized, is used to make drawing charcoal and in the manufacture of gunpowder (Mathieu Fl. For. 56).

Wood compact, even-grained, white. *Pores* very or extremely small. *Medullary rays* very fine and very numerous.

1. **E. crenulatus**, Wall.; Fl. Br. Ind. i. 608; Bedd. Fl. Sylv. t. 144.

A small evergreen tree. *Bark* grey, smooth. *Wood* light brownish-white, moderately hard, even-grained. *Pores* extremely small and numerous, evenly distributed. *Medullary rays* very fine, very numerous. *Annual rings* marked by a dark line.

Hills of S. India, common in the Nilgiri and Pulney hill sholas up to 8000 ft.

A harder, rather heavier wood than those of the North Indian species. Beddome thinks it would do as a substitute for boxwood, but it seems a little too open in texture.

	lbs.
W 4049. Lovedale, Ootacamund, 7000 ft. (Gamble)	47

2. **E. macrocarpus,** Gamble in Hook. Ic. Pl. No. 1763; Darj. List 18.

A large climbing shrub. *Wood* very white, soft, compact. *Pores* extremely small. *Medullary rays* very fine, very numerous.

Hill forests of British Bhutan at 7–8000 ft.

E 3667. Khumpung, Br. Bhutan, 7500 ft. (Gamble).

3. **E. grandifolius,** Wall.; Fl. Br. Ind. i. 608.

A small branching tree. *Bark* light brown, smooth, vertically wrinkled. *Wood* yellowish-white, moderately hard, close- and even-grained. *Pores* small, rather scanty. *Medullary rays* very fine, numerous.

Central Himalaya in Kumaon and Nepal at 3000 ft.; Khasia Hills at 4–6000 ft.
Khasia Hills, 5000 ft.—Kew Museum (J. D. Hooker).

4. **E. Hamiltonianus,** Wall.; Fl. Br. Ind. i. 612; Brandis For. Fl. 78, t. 16. *E. atropurpureus*, Roxb. Fl. Ind. i. 627. Vern. *Siki, singi, chual, watal, papar, rithu, randi, brahmáni, banchor, karún, skioch, sidhera, naga*, Pb.; *Dadúl, dharúa*, Jaunsar; *Agniun, agnu*, Kumaon.

A large deciduous shrub, or small or occasionally moderate-sized tree. *Bark* $\frac{3}{4}$ in. thick, grey, corky, with deep irregular fissures. *Wood* white, with a slight yellow tinge; soft, close- and even-grained. *Annual rings* marked by a narrow belt of firm wood with few pores. *Pores* extremely small, regular. *Medullary rays* extremely fine and numerous.

Outer Himalaya, from the Indus to Bhutan, usually in shady places and not very common, chiefly at 8–9000 ft.; Khasia Hills.

A beautiful wood, used for carving into spoons, and in China for engraving. It would do well for purposes for which a very even-grained soft wood is requisite. Weight 38½ lbs. The young shoots and leaves are lopped for fodder.

		lbs.
H 3173.	Dungagalli, Hazara, 8000 ft.	—
H 919.	Hazára, Punjab, 8000 ft. (Baden-Powell)	36
H 172.	Murree, Punjab (1866), 7000 ft.	—
H 778.	Kalatop Forest, Punjab, 7000 ft. (Pengelly)	34
H 2897, 3012.	Nagkanda, Simla, 9000 ft. (Gamble)	44
H 4770.	Balcha, Tehri-Garhwal, 9000 ft. "	40

5. **E. lacerus,** Ham.; Brandis For. Fl. 78. *E. fimbriatus*, Wall.; Fl. Br. Ind. i. 611. Vern. *Siki, pattali, papar, banchír, dudhapár, hanchu, pásh, mara, chíkan, rangchúl, kioch*, Punjab; *Gule, grui*, Simla; *Lichhoi, angáo*, Jaunsar.

A small deciduous tree. *Bark* smooth, grey. *Wood* white, moderately hard, exceedingly compact, close- and even-grained. *Annual rings* visible, but not very distinct. *Pores* extremely small, regular, barely visible under the lens. *Medullary rays* extremely fine and numerous.

Outer Himalaya, from the Indus to Sikkim, at 6–11,000 ft., in forests of oak or in open places or "tháchs" in the coniferous forests.

A pretty tree with even-grained white wood, which is used for carving. Weight 48 lbs. per cubic foot. The seeds are strung as beads in Bussahir and used for necklaces.

		lbs.
H 67.	Nagkanda, Simla, 9000 ft.	48
H 2883, 3011.	Nagkanda, Simla, 9000 ft. (Gamble)	46 and 49
H 3187.	Dungagalli, Hazara, 8000 ft.	—
	Nordlinger's Sections, vol. 9 (Tab. IV. 2).	

6. **E. pendulus,** Wall.; Fl. Br. Ind. i. 612; Brandis For. Fl. 79. Vern. *Bhambela*, Jaunsar; *Chopra, pincha, garúr, kúnku*, N.-W. Provinces.

A moderate-sized evergreen tree. *Bark* grey, rather corky, ¼ in. thick. *Wood* white, moderately hard, compact, with a light red tinge, very close- and even-grained. *Annual rings* marked by an almost continuous line of pores. *Pores* very small, very numerous, evenly distributed. *Medullary rays* extremely fine, very numerous.

Himalaya, from the Jhelum to Nepal, at 3–8000 ft., in valleys in the forests and shady places.

A pretty tree, the wood similar to but not quite so good as that of the last two species. It can also be used for carving. Flowers white.

		lbs.
H 86, 2837.	The Glen, Simla, 6000 ft.	35 and 41

7. **E. tingens,** Wall.; Fl. Br. Ind. i. 610; Brandis For. Fl. 79. Vern. *Kungku*, N.-W. Provinces; *Newar, kasuri*, Nepal; *Chopra, mer mahaul*, Simla; *Bhambeli, roini*, Jaunsar; *Gwáli, kúnkún*, Kumaon; *Keshiabaru*, Dotiál.

A small evergreen tree. *Bark* dark, rather corky outside and yellow within. The structure and appearance of the wood are the same as in *E. lacerus*, except that the wood of this species has a slightly reddish tinge.

Himalaya, from the Sutlej to Nepal, at 6–10,000 ft., in rather dry forests.

This species is easily recognized by its large flowers with pretty brown markings on the petals. The wood can be used for carving and utensils.

		lbs.
H 32.	Madhan, Simla, 7000 ft.	48
H 2844.	Mahasu, Simla, 8000 ft.	46
H 2881.	Nagkanda, Simla, 8000 ft.	—

8. **E. theæfolius,** Wall.; Fl. Br. Ind. i. 612; Gamble Darj. List 18.

A shrub. *Wood* white, moderately hard, compact. *Annual rings* distinct. *Pores* extremely small. *Medullary rays* very fine.

Central and Eastern Himalaya, at 5–8000 ft.; Khasia Hills.

E 3308. Rangbúl, Darjeeling, 7500 ft. (Gamble).

9. **E. frigidus,** Wall.; Fl. Br. Ind. i. 611; Gamble Darj. List 18.

A straggling shrub. *Wood* yellowish-white, moderately hard, compact. *Pores* extremely small. *Medullary rays* extremely fine. *Annual rings* marked by the darker colour of the autumn wood.

Himalaya, from Kumaon to Bhutan, at 8–12,000 ft.

E 3406. Tonglo, Darjeeling, 10,000 ft. (Gamble).

2. GLYPTOPETALUM, Thw. About four species, shrubs or small trees. *G. zeylanicum*, Thw.; Fl. Br. Ind. i. 612; Bedd. Fl. Sylv. lxiv.; Trimen Fl. Ceyl. i. 268, is a small tree of the Anamalai hills, the Tinnevelly and Travancore Gháts and the moist low country of Ceylon. Bourdillon says the wood is white, hard and close-grained. *G. sclerocarpum*, Kurz; Fl. Br. Ind. i. 613 (*Euonymus sclerocarpus*, Kurz For. Fl. i. 250), is a tree of the forests round Kambalataung in the Pegu Yoma. *G. calocarpum*, Prain in Journ. As. Soc. Beng. lx. ii. 209 (*Euonymus calocarpus*, Kurz; Fl. Br. Ind. i. 609) is a shrub of Tenasserim and the Andaman and Nicobar Islands. *G. grandiflorum*, Bedd. Fl. Sylv. lxv.; Fl. Br. Ind. i. 613, is a tree of the forests around Devala in S.E. Wynaad, at about 2–3000 ft.

3. MICROTROPIS, Wall.

About nine species, evergreen shrubs or trees, five of which are "shola" plants of the hills of South India. Three are found in Burma, two in Ceylon and one in the North-East Himalaya and Assam. *M. Wallichiana*, Wight; Fl. Br. Ind. i. 613; Bedd. Fl. Sylv. lxv.; Trimen Fl. Ceyl. i. 269, is an endemic tree common in the lower montane region of Ceylon. *M. longifolia*, Wall., and *M. bivalvis*, Wall.; Kurz For. Fl. i. 251, are shrubs or small trees of the forests of Tenasserim. *M. ramiflora*, Wight; Bedd. Fl. Sylv. lxv.; Trimen Fl. Ceyl. i. 269, is a tree of the sholas about Ootacamund and Avalanché in the Nilgiris at 7–8000 ft. and of the Ceylon hills. *M. latifolia*, Wight; Fl. Br. Ind. i. 613; Talbot Bomb. List 47, is a small tree with large wrinkled leaves of the forests about Sispara, extending northwards along the Ghâts to the Konkan; and *M. densiflora*, Wight; Fl. Br. Ind. i. 614; Bedd. Fl. Sylv. lxv., a small tree of the Nilgiri Western slopes.

Wood light-coloured, soft. *Pores* small, in radial groups. *Medullary rays* many, very fine. Faint concentric lines.

1. **M. discolor**, Wall.; Fl. Br. Ind. i. 614; Kurz For. Fl. i. 251; Gamble Darj. List 18. *Euonymus garcinifolius*, Roxb. Fl. Ind. i. 628. Vern. *Suglim*, Lepcha; *Mori*, Sylhet.

An evergreen shrub. *Bark* very thin, greenish-grey. *Wood* white, soft. *Pores* very small, rather unevenly distributed in long radial broken strings. *Medullary rays* very fine, very numerous. Faint, concentric white lines.

Found in the undergrowth of the forests of the Central Himalaya up to 7000 ft., from Kumaon to Sikkim; the Khasia Hills and damp hill forests of Burma, as far north as Myitkyina.

	lbs.
E 3345. Lebong, Darjeeling, 6000 ft. (Gamble)	30

2. **M. microcarpa**, Wight; Fl. Br. Ind. i. 614; Talbot Bomb. List 47.

An evergreen shrub or small tree. *Bark* grey, rather rough, very thin. *Wood* grey, soft. *Pores* in long groups, sometimes oblique, very small. *Medullary rays* very fine, very numerous. Faint, pale concentric lines.

Hill forests of South India, especially the Nilgiris, 6–7000 ft., extending north to the Konkan.

W 3742. Coonoor, Nilgiris, 6000 ft. (Gamble).

3. **M. ovalifolia**, Wight; Fl. Br. Ind. i. 614; Bedd. Fl. Sylv. lxv.

An evergreen tree. *Bark* thin, grey, rough. *Wood* light yellowish-brown, soft. *Pores* rather scanty, in long radial groups. *Medullary rays* very fine, very numerous. Faint, pale concentric lines.

Hill forests of the Nilgiris, about 6–8000 ft., extending south to Tinnevelly.

	lbs.
W 3777. Coonoor, Nilgiris, 6000 ft. (Gamble)	—
W 3858, 4084. Ootacamund, 7000 ft. (Gamble)	37

4. LOPHOPETALUM, Wight.

A genus containing seven species of Indian trees, of which six are Burmese, one from Eastern Bengal, and one from South India. *L. fimbriatum*, Wight; Fl. Br. Ind. i. 615, is a tree of Sylhet and Tenasserim; and *L. floribundum*, Wight, is a tree of Tenasserim. There is a tall cylindrical-stemmed tree, of this genus apparently, in the forests of the lower Darjeeling hills, having large winged seeds, which I have not identified fully.

Wood light, soft to moderately hard, even-grained, somewhat shining. *Pores* small to moderate-sized. *Medullary rays* very fine, very numerous. Concentric very narrow dark lines of loose cellular tissue, prominent, interrupted, wavy.

1. **L. littorale,** Kurz For. Fl. i. 255. *Kokoona littoralis*, Lawson; Fl. Br. Ind. i. 617. Vern. *Môn-daing*, Burm.

A tree. *Wood* grey, moderately hard, even-grained. *Pores* small and moderate-sized, often oval and subdivided. *Medullary rays* very fine, uniform and equidistant, very numerous; the distance between the rays much less than the transverse diameter of the pores. Numerous parallel, concentric, wavy lines.

Pegu and Tenasserim, especially on the inundated low lands along rivers.
Weight, on an average, 35 lbs. per cubic foot.

		lbs.
B 278.	Burma (1867)	27
B 2513	„ (Brandis, 1862)	36
B 2300.	Andaman Islands (Col. Ford, 1866) doubtful	41

2. **L. Wallichii,** Kurz For. Fl. i. 255; Fl. Br. Ind. i. 615. Vern. *Môn-daing*, Burm.

A large tree. *Wood* grey, moderately hard. *Pores* moderate-sized, scanty, in short radial lines. *Medullary rays* very fine, not so uniform and not so numerous as in *L. littorale.* Numerous very narrow, parallel, concentric, interrupted wavy dark lines of large wood-cells.

Tenasserim, Tavoy and the Andamans.
There is just a little doubt of the identity of the specimens. Kurz says the wood is recommended for furniture. Col. Ford says it is used in the Andamans for writing-boards, and the bark, root and fruit as a febrifuge.

		lbs.
B 1947.	Tavoy (Vern. *Kanazo-ta-loo*) (Seaton)	31
B 2248.	Andaman, 1866 (Vern. *Taunghmayo*)	—

3. **L. Wightianum,** Arn.; Fl. Br. Ind. i. 615; Bedd. Fl. Sylv. t. 145; Talbot Bomb. List 47. Vern. *Balpalé*, Kan.; *Vengalkattei*, Tam.; *Vengkotta*, *karuka*, Mal.; *Vengkadavan*, Trav. Hills.

A large evergreen tree. *Wood* reddish-grey, moderately hard, close-grained, structure similar to that of *L. littorale*. *Pores* large, usually subdivided, sometimes in short strings. *Medullary rays* fine, conspicuously bent round the pores when they meet them. Parallel narrow concentric lines prominent.

Western coast from the Konkan to Cape Comorin, in evergreen forests and on river-banks up to 3000 ft.
Weight 28 to 29 lbs. per cubic foot. The wood is much esteemed in South Kanara, where it is used for house-building. Bourdillon gives W = 30 lbs., P = 467, and says it is "durable if smoked."

		lbs.
W 723, 853.	South Kanara (Cherry)	29 and 28
W 4618.	Travancore (Bourdillon)	27
	Nordlinger's Sections, vol. 10.	

5. KOKOONA, Thwaites. *K. zeylanica*, Thw.; Fl. Br. Ind. i. 616; Bedd. Fl. Sylv. t. 146; Trimen Fl. Ceyl. i. 270; Vern. *Kokuh*, *wana-potu*, Cingh., is a very large tree of the forests of the moist region of Ceylon at 1–4000 ft. Trimen says of it,

'*Wood* pale yellowish-brown, smooth, light, readily splitting. The inner bark is of a brilliant yellow colour, and is used by jewellers for polishing gold embroidery and also as a snuff when powdered." It has also been found by Beddome on the Anamalai Hills of Coimbatore.

6. PLEUROSTYLIA, Wight.

1. P. Wightii, W. and A.; Fl. Br. Ind. i. 617; Bedd. Fl. Sylv. lxvi.; Talbot Bomb. List 48; Trimen Ceyl. Fl. i. 271. Vern. *Chiru-piyari*, Tam.; *Piyari, panaka*, Singh.

A small evergreen tree. *Bark* ⅛ in. thick, grey, tessellated in small rectangular squares: inner bark yellow. *Wood* light red, yellowish-red or greyish, moderately hard, close- and even-grained, divided into belts of narrow dark tissue with no or few pores and broader light tissue with pores, the dark tissue very prominent on vertical sections. *Pores* very small, scanty. *Medullary rays* fine, very numerous, equidistant.

Evergreen dry forests of the Deccan and Carnatic, especially near watercourses; dry country of Ceylon.

A very pretty wood, used in Cuddapah to make combs. The fruit is white, like a small egg.

The experiments made by Prof. W. C. Unwin, F.R.S., for the Imperial Institute, on Ceylon wood, gave the following results (*Imp. Inst. Journ.*, May, 1899):—

Weight	54·86 lbs. per cubic foot.		
Resistance to shearing along the fibres . .	745 lbs. per square inch.		
Crushing stress	2·768 tons per square inch.		
Coefficient of transverse strength . . .	5·784	,,	,,
Coefficient of elasticity	658·3	,,	,,

	lbs.
C 3955. Rekapalle Forests, Upper Godavari (Gamble)	48
No. 152, Ceylon Collection, new (Mendis) (*Weera*).	
Ceylon: Int. Exhn., 1862—Kew Museum.	

7. CELASTRUS, Linn.

As settled in the "Gen. Plantarum," i. 997, 998, I include with this genus the genus GYMNOSPORIA of the Fl. Br. Ind. This is in accord with Brandis, Beddome and Kurz. Talbot and Trimen retain GYMNOSPORIA; so does King (Journ. As. Soc. Beng. lxv. ii. 354), though he expresses himself as doubtful on the subject; and so, too, does the "Index Kewensis." The *Celastrus* section of the genus consists of four climbing shrubs, the *Gymnosporia* section of about 16 shrubs or small trees, mostly thorny.

C. stylosa, Wall. and *C. monosperma*, Roxb.; Fl. Br. Ind. i. 618; Gamble Darj. List 18, 19, are large climbing shrubs of Northern and Eastern Bengal.

C. Rothiana, W. and A.; Fl. Br. Ind. i. 620; Talbot Bomb. List 48; Vern. *Gawlin, moti yekkadi*, Mar., is a shrub of the evergreen forests of the Konkan and North Kanara. *Gymnosporia pallida*, Coll. and Hemsl.; Journ. Linn. Soc. xxviii. 32, is a shrub of the Shan and Kachin Hills of Burma, at 3-4000 ft. With the exception of these and the species whose wood is described, the *Gymnosporia* shrubs have no particular interest.

Wood close- and even-grained. *Pores* small or very small. *Medullary rays* very fine and very numerous. Concentric bands prominent in most species, caused by variations in the size of the wood-cells, some of the cells being filled with a dark resin-like substance. *C. paniculata* has the usual loose structure of a climber.

1. C. paniculata, Willd.; Fl. Br. Ind. i. 617; Roxb. Fl. Ind. i. 621; Brandis For. Fl. 82; Kurz For. Fl. i. 252; Gamble Darj. List 18; Talbot Bomb. List 48;

Trimen Fl. Ceyl. i. 272. *C. nutans*, Roxb. Fl. Ind. i. 623. Vern. *Múlkakni, mal kangani, kond gaidh*, Hind.; *Kakundan, rangul, wahrangur*, C.P.; *Kanguni, pigavi*, Mar.; *Pinguel*, Melghát; *Kujúri*, Kól; *Kujri*, Sonthal; *Chiron*, Mal Pahari; *Ruglim*, Lepcha; *Korsano, noi bada*, Uriya; *Kariganne*, Kan.; *Duhudu*, Cingh.; *Wina, myingaungnayaung*, Burm.

A large climbing shrub. *Bark* usually yellow, corky, sometimes fibrous, spirally twisted and smooth. *Wood* porous, soft, very variable, according to locality and climate. *Pores* usually large, in lines between the moderately broad or broad *medullary rays*, sometimes very large in the annual rings.

Throughout India, Burma and Ceylon; common in the deciduous forests especially. An orange-coloured oil is extracted from the seeds and used medicinally and occasionally burnt. Destructive distillation of the seeds gives a black oil called "Oleum nigrum" by pharmaceutists, who chiefly used it as a diuretic.

		lbs.
O 4648.	Saharanpur Forests, N.-W. Provinces (Gamble)	47
E 2334.	Tukdah Forest, Darjeeling, 5000 ft. „	51
C 3448.	Barasand Reserve, Palamow (Gamble)	—
C 3842.	Kurcholy Forests, Ganjam „	—

Nordlinger's Sections, vol. 4 (*C. nutans*).

2. **C. oxyphylla**, Wall. *C. acuminata*, Wall.; Kurz For. Fl. i. 252; Gamble Darj. List 19. *Gymnosporia acuminata*, Hook. f.; Fl. Br. Ind. i. 619. Vern. *Phugong*, Lepcha.

A large thorny shrub. *Bark* greyish-white, thin. *Wood* white, hard, close-grained, with numerous pale concentric bands. *Pores* very small, evenly distributed. *Medullary rays* very fine, very numerous.

Sikkim Himalaya at 4–7000 ft.; Khasia Hills; Northern Circars, on Mahendragiri, 4000 ft.; Upper Burma.

E 3391. Lebong, Darjeeling, 5500 ft. (Gamble).
Nordlinger's Sections, vol. 7.

3. **C. rufa**, Wall.; Brandis For. Fl. 80. *Gymnosporia rufa*, Wall.; Fl. Br. Ind. i. 620.

A small tree. *Bark* dark brown, rough, tessellated in small scales, ¼ in. thick. *Wood* red, hard, close-grained. *Pores* small, usually in radial or somewhat oblique lines. *Medullary rays* fine, numerous. Concentric lines thin but well-marked, irregularly spaced.

Himalaya, from the Jumna to Bhutan, up to 6000 ft.; Khasia Hills; Northern Circars.

C 3827. Mahendragiri Hill, Ganjam, 4000 ft. (Gamble).

4. **C. spinosa**, Royle; Brandis For. Fl. 80. *Gymnosporia Royleana*, Wall.; Fl. Br. Ind. i. 620. Vern. *Dzaral*, Trans-Indus; *Kandu, kandiári, pataki, lei, phúpari, badlo, kadewar*, Pb.; *Kúra, bagriwála darim, gwála darim*, N.-W. Provinces.

A thorny shrub. *Bark* thin, grey, corky. *Wood* lemon-coloured, hard and close-grained, with numerous concentric bands. *Pores* very small. *Medullary rays* very fine, very numerous.

Outer Western Himalaya, from Kumaon westwards, on hot dry rocky slopes and often on Kankar.

The wood deserves attention as possibly suitable for carving and engraving; it resembles boxwood in texture.

		lbs.
P 913.	Salt Range, Punjab	49
H 2932.	Suni, Simla, 3000 ft.	49
H 2950.	Sutlej Valley, Punjab, 3500 ft. (Gamble)	—

5. **C. emarginata,** Willd.; Roxb. Fl. Ind. i. 620; Bedd. Fl. Sylv. lxvi. *Gymnosporia emarginata,* Roth; Fl. Br. Ind. i. 621; Talbot Bomb. List 48; Trimen Fl. Ceyl. i. 273. Vern. *Bali bhains, gouro kosai,* Uriya; *Sinni,* Palkonda; *Yenkul, ingli, ikari,* Mar.

A thorny shrub. *Bark* whitish-grey, ⅛ in. thick, somewhat corky. *Wood* white, hard, in structure resembling that of *C. spinosa.*

Orissa, West and South India and Ceylon; a common shrub on dry laterite soils.

C 3521. Khurdha Forests, Orissa (Gamble).
D 3866. Kottakota Forest, Anantapur (Gamble).

6. **C. senegalensis,** Lam.; Bedd. Fl. Sylv. lxvi.; Brandis For. Fl. 81; Kurz For. Fl. i. 252. *C. montana,* Roxb. Fl. Ind. i. 620. *Gymnosporia montana,* Lawson in Fl. Br. Ind. i. 621; Talbot Bomb. List 48. Vern. *Sherawane,* Trans-Indus; *Talkar, dajkar, mareila, kingaro, kharái,* Pb.; *Baikal, gajachinni,* C.P.; *Bekal, yekal,* Berar; *Mál kanguni,* Bombay; *Danta, babur,* Gondi; *Dhatti,* Bhil; *Bharatti, yekal, yekkadi,* Mar.; *Danti, dantáusi, pedda chintú,* Tel.

A tall spinescent shrub. *Bark* ⅙ in. thick, grey, with longitudinal cracks, exfoliating in small scales. *Wood* light reddish-brown, soft, close-grained. *Pores* small, numerous, uniformly distributed. *Medullary rays* very fine, very numerous. Faint concentric lines very numerous.

Dry and arid forests in the Punjab, Sind, Baluchistan, Rajputana and North-West India, ascending to 4000 ft.; Central India and the drier parts of the Peninsula.

Weight 45 lbs. per cubic foot. Wood durable, but not used. The leaves are used for fodder, and the branches as dunnage for the roofs of houses (Brandis).

		lbs.
C 1162.	Ahiri Reserve, Central Provinces (R. Thompson)	—
C 2752.	Moharli „ „ „ (Brandis)	46
D 3898.	Kottakota Reserve, Anantapur (Gamble)	44
	Nordlinger's Sections, vol. 11.	

8. KURRIMIA, Wall.

Four species. *K. pulcherrima,* Wall.; Fl. Br. Ind. i. 622 (*K. robusta,* Kurz For. Fl. i. 253. *Celastrus robusta,* Roxb. Fl. Ind. i. 626); Vern. *Kwedauk,* Burm., is a large evergreen tree of the tropical forests of Tenasserim extending to Pegu and northwards to Chittagong, with a brown, heavy, fibrous and close-grained but brittle wood (Kurz). *K. bipartita,* Laws. is a tree of the Sivagiri Hills in South India.

1. **K. zeylanica,** Arn.; Fl. Br. Ind. i. 622; Bedd. Fl. Sylv. t. 147; Trimen Fl. Ceyl. i. 274. Vern. *Konnai,* Tam.; *Palen, etheraliya, uruhonda,* Cingh.

A large tree. *Bark* smooth, dark grey, thick. *Wood* pale yellowish-brown, moderately hard. *Pores* small, rather scanty. *Medullary rays* fine, numerous. Concentric rings of loose tissue, very narrow, not prominent. Occasional dark bands.

Moist region of Ceylon, up to 5000 ft.

Mendis says the wood is used for tea-chests, packing-cases, and furniture backs.

No. 31, Ceylon Collection, new (Mendis).

2. **K. paniculata,** Wall.; Fl. Br. Ind. i. 622. *Trochisandra indica,* Bedd. Fl. Sylv. t. 120. Vern. *Perungundu,* Kader.

A large tree. *Wood* white to greyish-brown, moderately hard. *Pores* small, very scanty. *Medullary rays* fine, numerous, bent round the pores. Concentric rings of loose tissue numerous, not very

prominent and much broken. Occasional dark bands without pores, which may be annual rings.

Hills of South India: damp forests of the Anamalais at 3–6000 ft.; hills of Travancore, abundant at Peermord.

The woods of the two specimens differ in colour, but agree in structure. Bourdillon gives W = 40 lbs., P = 505.

		lbs.
W 4634, 4538.	Travancore (Bourdillon)	43 and 34

9. ELÆODENDRON, Jacq. fil.

1. **E. Roxburghii**, W. and A.; Bedd. Fl. Sylv. t. 148; Brandis For. Fl. 82; Gamble Darj. List 19. *E. glaucum*, Pers.; Fl. Br. Ind. i. 623; Roxb. Fl. Ind. i. 638; Talbot Bomb. List 48; Trimen Fl. Ceyl. i. 271. *Neerija dichotoma*, Roxb. Fl. Ind. i. 646. Vern. *Mirandu*, *padriún*, *bakra*, *janwa*, Pb.; *Bhutta*, Kashmir; *Bakra*, *shauria*, *chauli*, *daberi*, *mámri*, N.-W. P.; *Dhebri*, Dehra Dún: *Chauri*, *metkúr*, Oudh; *Chikyeng*, Lepcha; *Jamrási*, *kala mukha*, *rohi*, C.P.; *Bhutikassi*, *jamrási*, Berar; *Dhakka*, *nisur*, Gondi; *Niru*, Kurku; *Ratangeru*, Koderma; *Miri*, Kól; *Aran*, *tamruj*, *bilúr*, *buta pala*, *burkas*, Mar.; *Buta karas*, Bhil; *Karkava*, *irkuli*, *selupa*, *siri*, *karuvali*, *piyari*, Tam.; *Nirija*, *neradi*, *botanskam*, *kanemis*, *bootigi*, Tel.; *Bhutrakshi*, Hyderabad; *Neralu*, Cingh.

A tree. *Bark* $\frac{1}{6}$ in. thick, grey, often blackish, exfoliating in four-sided very small scales. *Wood* moderately hard, even- and close-grained, light brown, often with a red tinge; the outer wood white, but no distinct sapwood; no *annual rings*. Numerous, wavy, concentric, lighter-coloured bands. *Pores* small, scanty. *Medullary rays* fine, short, very numerous, visible on a radial section, as a pretty silver-grain, which is assisted by the alternations of the dark and light bands.

Throughout the greater part of India: common in the Siwalik tract, outer hills and valleys of the Himalaya up to 6000 ft. from the Ravi to Sikkim; Oudh, Behar, Central India, Orissa, Circars, Deccan and Carnatic, also Western Ghâts, in deciduous forests.

A graceful tree with a pretty wood, which is used for cabinet work and picture frames. It seasons well, but requires careful treatment, as thin planks are somewhat liable to warp. Weight: Brandis gives 40 to 50 lbs.; Skinner and Fowke, 46 lbs.; R. Thompson, 53 lbs.; C. P. List, 40 lbs.; the specimens examined average 53 lbs. Skinner, No. 65, gives P = 513, Fowke P = 511. The root is said to be specific against snake-bite, and the bark is used in native medicine, said to be a virulent poison (Brandis). It gives a small amount of gum. The tree prefers clay soils.

		lbs.
O 235.	Garhwal (1868)	56
O 2991.	„ (1874)	48
C 183.	Mandla, Central Provinces (1870)	50
C 1182.	Ahiri Reserve, Central Provinces (R. Thompson) . . .	55
C 2781.	Melghát, Berar (Brandis)	49
E 2335.	Bamunpokri, Darjeeling Terai (Gamble)	57
D 3987.	Ballipalle Forest, Cuddapah „	58
No. 63, Ceylon Collection, old		56

10. HIPPOCRATEA, Linn.

About ten species of climbing shrubs. *H. arborea*, Roxb. Fl. Ind. i. 167; Fl. Br. Ind. i. 625; Brandis For. Fl. 83; Vern. *Katha-paharia*, Beng.; *Ainth*, Oudh, is found abundantly in the forests of Oudh, extending to Northern Bengal. *H. indica*, Roxb. Fl. Ind. i. 165; Fl. Br. Ind. i. 624; Brandis For. Fl. 83; Talbot Bomb. List 49; Trimen Fl. Ceyl. i. 276; Vern. *Kazurati*, *turruli*, Mar., is found in most of the warmer parts of India and Ceylon, scarce in Burma. *H. Grahami*, Wight, is found in Bombay,

1. H. obtusifolia, Roxb. Fl. Ind. i. 166; Fl. Br. Ind. i. 623 (excl. syn.); Talbot Bomb. List 49; Trimen Fl. Ceyl. i. 275. Vern. *Daushir*, Mar.; *Diya-kirindi-wel*, Cingh.

A climbing shrub. *Bark* grey, corky, rough, vertically fissured, inner bark yellow. *Wood* in radial wedges separated by soft (bast ?) tissue in deep bays from the outside, moderately hard. *Pores* moderate-sized, regular, between the broad *medullary rays*.

Evergreen forests of the Deccan and Carnatic, frequent in Nellore near the coast; Konkan and Kanara; Ceylon.

D 4254. Ballipalle Forests, Cuddapah (Gamble).
D 4153. Dornál Forests, Kurnool „

11. SALACIA, Linn.

About 18 species, mostly climbing or straggling shrubs, not common, and of slight importance.

S. prinoides, DC; Fl. Br. Ind. i. 626; Kurz For. Fl. i. 260; Talbot Bomb. List 50; Trimen Ceyl. Fl. i. 276 (*Johnia coromandeliana*, Roxb. Fl. Ind. i. 169); Vern. *Dimal*, *modhuphal*, Beng.; *Nisul-bondi*, Mar.; *Hin-himbutu-wel*, Cingh., is a straggling or climbing shrub of the Northern Circars and Orissa, of the Konkan and Kanara Ghâts, of the low country of Ceylon and of tidal forests in Burma, the Andamans and Cocos Islands, with a very bad smell. *S. oblonga*, Wall.; Fl. Br. Ind. i. 628; Talbot Bomb. List 50; Trimen Ceyl. Fl. i. 277; Vern. *Chundan*, Tam., is a large climbing shrub of Western and South India and Ceylon, with a big fruit. *S. Roxburghii*, Wall.; Fl. Br. Ind. i. 627; Kurz For. Fl. i. 259 (*Johnia salacioides*, Roxb. Fl. Ind. i. 168), is found in the Sikkim Himalaya, and in Chittagong, Martaban and Tenasserim.

1. S. verrucosa, Wight; Fl. Br. Ind. i. 628; Kurz For. Fl. i. 259.

A large scandent shrub, the stem deeply grooved. *Bark* yellowish-white, thin, with corky lenticels. *Wood* light brown, soft, in irregular masses separated by hard bast tissue. In the wood masses, *pores* very large, irregular, much subdivided, more or less radially arranged. *Medullary rays* fine, numerous, inconspicuous.

Tropical forests of Martaban and Tenasserim.
Java—Kew Museum (M. Treub).

12. SIPHONODON, Griff.

1. S. celastrineus, Griff.; Fl. Br. Ind. i. 629; Kurz For. Fl. i. 254. Vern. *Myaukokshit*, Burm.

An evergreen tree. *Bark* of young trees grey, granular; of old trees darker, rougher, with corky lenticels. *Wood* white, often bluish-grey inside, but scarcely a heartwood; soft to moderately hard, even-grained. *Pores* small to moderate-sized, scanty, often subdivided. *Medullary rays* fine, uniform, numerous. *Annual rings* marked by a line without pores in the autumn wood.

Tropical forests of Burma, especially on the eastern slopes of the Pegu Yoma and in Martaban; Little Coco Island, abundant, less common on Great Coco (Prain).

		lbs.
B 5021.	Tharrawaddy, Burma	37
B 5101.	Toungoo, Burma	48

ORDER XXXIV. RHAMNEÆ.

Contains twelve Indian genera, of which six are climbing or straggling shrubs and the remainder shrubs or small trees. The Order is subdivided into four Tribes:—

Tribe	I. Ventilagineæ	Ventilago, Smythea.
„	II. Zizypheæ	Zizyphus, Berchemia.
„	III. Rhamneæ	Rhamnus, Hovenia, Scutia, Sageretia, Colubrina.
„	IV. Gouanieæ	Apteron, Gouania, Helinus.

The Order is not one of great importance as giving timber trees, but some of the species of *Zizyphus* are important in the forest economy of the dry regions of India. *Noltia africana*, Harv. and Sond., is a Cape shrub, introduced into and run wild in the Nilgiris, where also some species of *Pomaderris* are occasionally similarly found.

Wood hard or moderately hard. *Pores* small or moderate-sized. *Medullary rays* fine or very fine, numerous, equidistant. The arrangement of the pores in patches in *Rhamnus* is characteristic of the genus.

1. VENTILAGO, Gaertn.

Five species are described in the Fl. Br. Ind., but King (Journ. As. Soc. Beng. lxv. ii. 665) considers that the two common species, *V. maderaspatana*, Gaertn., and *V. calyculata*, Tul., are really one, and so I propose to consider them. Two other species occur in Tenasserim, and one, rare and doubtful, in the Konkan.

1. V. madraspatana, Gaertn.; Fl. Br. Ind. i. 631; Roxb. Fl. Ind. i. 629; Brandis For. Fl. 96; Kurz For. Fl. i. 262; Talbot Bomb. List 51; Trimen Fl. Ceyl. i. 279. *V. calyculata*, Tul.; Fl. Br. Ind. i. 631; Brandis For. Fl. 96; Kurz For. Fl. i. 262; Talbot Bomb. List 51. Vern. *Kali bél*, Dehra Dún; *Raktapita, kala lag*, Kumaon; *Raktapita*, Beng.; *Lokandi, kanwail*, Bombay; *Kharbel*, Berar; *Sakal yel*, Mar.; *Papri*, C.P.; *Bonga sarjam*, Kól; *Kyonti*, Kharwar; *Saji malo*, Khond; *Chorgu*, Hyderabad; *Yerra chictali, surati chekka*, Tel.; *Papli*, Tam. Kan.; *Vempadam*, Tam.; *Yaccada-wel*, Cingh.; *Wasonwè*, Burm.

A large climbing shrub. *Bark* dark grey with vertical cracks, exposing the inner surface, which has a vermilion colour. *Wood* yellow, porous, soft. *Pores* large, oval, often transversely subdivided. *Medullary rays* moderately broad, undulating, bent at the pores.

Throughout the plains of India, chiefly in the drier forests, also in Burma and Ceylon, ascending the hills to some extent in the centre and south.

A very conspicuous forest climber, climbing over the tallest trees and hanging its branches down in festoons. The bark is made into cordage, and the bark of the root, which gives a valuable dye, is an important article of minor forest produce in the Deccan and Carnatic, also in the Nilgiris. It is also used in native medicine.

		lbs.
C 2920.	Central Provinces	—
C 3484.	Saranda Forests, Singbhúm (Gamble)	—
C 3843.	Vishnuchakram Forests, Ganjam (Gamble)	—
D 4330.	Juddengi Forest, Godavari (Gamble)	47

2. SMYTHEA, Seem. *S. calpicarpa*, Kurz For. Fl. i. 264; Fl. Br. Ind. i. 632, is a scandent evergreen shrub of Tenasserim.

3. ZIZYPHUS, Juss.

About 16 species, and there are others, for I have at least one from the South Deccan which I do not find anywhere described. *Z. wynadensis*, Bedd. Fl. Sylv. lxviii.; Fl. Br. Ind. i. 633, is a large tree of the Wynaad. *Z. Napeca*, Willd.; Fl. Br. Ind. i. 635;

Bedd. Fl. Sylv. lxix.; Trimen Fl. Ceyl. i. 281 (includes also *Z. lucida*, Moon, and *Z. Linnæi*, Laws., in Fl. Br. Ind.); Vern. *Yak-eraminiya*, Cingh., is a shrub of the low country of Ceylon. *Z. horrida*, Roth; Fl. Br. Ind. i. 636; Talbot Bomb. Fl. 52, is a thorny shrub of dry tracts in the Konkan, Circars and Deccan. *Z. glabra*, Roxb. Fl. Ind. i. 614; Kurz For. Fl. i. 267, is a climbing shrub of the forests of Chittagong and Burma, and of the Andaman and Nicobar Islands. *Z. Spina-Christi*, Lam., is cultivated about villages in Baluchistan (Lace).

Wood reddish, moderately hard or hard, no heartwood. *Pores* small to moderate-sized, often subdivided, between numerous fine or very fine *medullary rays*.

1. **Z. Jujuba**, Lam.; Fl. Br. Ind. i. 632; Roxb. Fl. Ind. i. 608; Bedd. Fl. Sylv. t. 149; Brandis For. Fl. 86, t. 17; Kurz For. Fl. i. 266; Gamble Darj. List 19; Talbot Bomb. List 52; Trimen Fl. Ceyl. i. 280. The Jujube. Vern. *Bér, baer, beri*, Hind.; *Kúl, bér*, Beng.; *Rengha, regi*, Tel.; *Yellande, ellandi*, Tam.; *Bhor, bér*, Mar.; *Renga*, Bhíl; *Elentha*, Mal.; *Yelchi, ilanji, ilantai*, Kan.; *Yellantha*, Madura; *Boray*, Melghát; *Jóm janóm*, Sonthal; *Janumjan*, Kól; *Boré*, Khond; *Ringa*, Gondi; *Bor*, Baigas; *Bogri*, Rajbanshi; *Jibang*, Magh; *Bér, bogri*, Ass.; *Boro-koli*, Uriya; *Zi*, Burm.; *Maha-debara*, Cingh.

A moderate-sized deciduous thorny tree, almost evergreen. *Bark* ⅓ in. thick, dark grey, nearly black, with irregular cracks. *Wood* hard, reddish; no heartwood. *Annual rings* distinct in specimens from N. India, indistinct in those from warmer regions. *Pores* small or moderate-sized, scanty, often oval and subdivided. *Medullary rays* fine, very numerous, uniform and equidistant; the distance between two rays much less than the transverse diameter of the pores. Pores frequently joined by short fine concentric lines.

Distinctly wild in the forests of the Siwaliks and sub-Himalayan tract of the Punjab and North-Western Provinces, and also in the Deccan and in Upper Burma and Ceylon in dry forests. Elsewhere mostly cultivated or run wild.

An important tree in the dry regions, as it comes up readily and easily on poor land and grows quickly, furnishing an excellent fuel, much material for hedging, food for camels and goats in its leaves, and for man in its fruit. It is very variable in appearance, size and shape and pubescence of leaves, and size, colour and shape of fruit. In the grass-lands of the Dún it comes up freely as a small-leaved, small-fruited shrub of quite distinct appearance, but if allowed to grow will, I believe, become a tree and adopt the characteristic appearance of a short bole with spreading branches and rounded head, killing the vegetation beneath. But it may sometimes grow very large, *e.g.* the tree mentioned by E. D. M. Hooper (Ind. For. vii. 227) on the Weinganga C.P., which was 80 ft. high with a girth of 16¾ ft. at 5 ft. from the ground. It coppices well, and gives a good fuel for lime-burning and good charcoal.

The wood is universally used for saddletrees, also for agricultural implements, sandals, bedstead-legs, tent-pegs, oil-mills, golf-clubs (Chicago Exh. Cat.) and other purposes. Coldstream says it is the best tree in the Punjab to grow lac on (Ind. For. vi. 218). In Assam, the Eri silkworm, which is usually fed on leaves of Castor-oil or *Heteropanax*, is sometimes fed on it (Stack). It is one of the food-plants of the caterpillar of the butterfly *Papilio erithonius*, Cramer, and of the tásar silkworm *Antheræa paphia*, Linn. The root bark is used for tanning. The growth is often fast, a Saharanpur specimen giving 4 rings per inch, other specimens 6 rings. The fruit is eaten by many wild animals, including jackals, who thus help to propagate the tree. For its fruit the tree is regularly cultivated all over India, and the cultivated fruit, which is usually egg-shaped and not round like that of the wild tree, is pleasant to eat. It is often dried, and the dried fruits are sometimes brought from Afghanistan by traders.

The weight of the wood, according to Skinner, No. 135, is 58 lbs. per cubic foot; Cunningham gives 57 lbs.; the specimens an average of 48 lbs. Cunningham gives P = 495; Skinner, 672. The experiments made by Prof. W. C. Unwin, F.R.S., for the Imperial Institute, on Ceylon woods, gave the following results (*Imp. Inst. Journ.* May, 1899):—

Weight	48.87 lbs. per cubic foot.
Resistance to shearing along the fibres	1013·4 lbs. per square inch.
Crushing stress	2·778 tons per square inch.
Coefficient of transverse strength	3·479 „ „
Coefficient of elasticity	426·7 „ „

The Lymantriid moth, *Thiacidas postica*, Walk., feeds on the leaves and defoliates the tree. It is frequently attacked by the dodder, *Cuscuta reflexa*, Roxb., which often covers its branches with a yellow sheet.

		lbs.
O 265.	Garhwal (1868)	—
O 4736.	Kasumri Forests, Saharanpur (Gradon)	45
C 2815.	Melghat, Berar (Brandis)	—
C 1128.	Ahiri Reserve, C.P. (R. Thompson)	43
C 3788.	Surada Forests, Ganjam (Gamble)	54
D 1071.	North Arcot (Wooldridge)	52

Nordlinger's Sections, vol. II (*Rhamnus Jujuba*, L.) (Tab. IV. 3).

2. Z. trinervia, Roxb. Fl. Ind. i. 606. *Z. glabrata*, Heyne; Fl. Br. Ind. i. 633; Bedd. Fl. Sylv. lxviii. Vern. *Karukava*, Tam.

A small unarmed tree. *Wood* hard, close-grained, olive-brown, smooth. *Pores* moderate-sized, often subdivided, evenly distributed. *Medullary rays* fine, white, distinct. Occasional fine concentric lines.

North-East Himalaya, Nilgiri Hills, Coimbatore and Mysore, and south to Travancore.

		lbs.
D 4249.	Collegal Forests, Coimbatore (Peét)	70

3. Z. nummularia, W. and A.; Fl. Br. Ind. i. 633; Bedd. Fl. Sylv. lxix.; Brandis For. Fl. 88. *Z. microphylla*, Roxb. Fl. Ind. i. 613; Talbot Bomb. List 52. Vern. *Karkanna*, Afgh.; *Malla, bér, birár, jhari, kanta*, N.-W. P.; *Gangr, jangra*, Sind; *Jhari*, Jeypore; *Bhor, jhalbhor*, Merwara; *Parpaili gidda*, Kan.

A thorny shrub. *Bark* grey. *Wood* yellow, hard, compact, in structure similar to that of *Z. Jujuba*, except that the *pores* are larger and the *medullary rays* are somewhat further apart; the distance between the rays is less than the transverse diameter of the pores.

A gregarious shrub characteristic of the arid and dry regions where it covers extensive areas in the Punjab, Sind, Baluchistan, Rajputana, Central India, and the Deccan. It is very common on black cotton soil.

Bonavia (*Gard. Chron.*, 1884) describes how the bushes of this shrub in desert regions form mounds by stopping leaves or dust and other things when the hot winds blow. The fruit is eaten by jackals, who thus help to scatter the seeds.

Growth: No. P 2931 shows well-marked annual rings and a fast growth of 2 to 3 rings per inch of radius. Weight, 43 lbs. per cubic foot on an average. The branches are used to make fences round fields and gardens. The leaves are threshed out and used as fodder for sheep and goats. The fruit is eaten.

		lbs.
P 2931.	Bhajji, Simla, 3000 ft.	41
P 3077, 3093.	Sabathu, Punjab, 3000 ft.	42
P 442.	Ajmere	46

4. Z. vulgaris, Lamk.; Fl. Br. Ind. i. 633; Brandis For. Fl. 85; Roxb. Fl. Ind. i. 609. *Jujubier*, Fr.; *Giuggiolo*, Ital. Vern. *Sinjli, simli, bán, barj, phitni, bér, kandika, kandiári, birári*, Pb.

A large shrub or small tree. *Bark* rough, with longitudinal furrows, dark grey. *Wood* pale yellowish-brown, heartwood dark brown, even-grained. *Pores* moderate-sized, evenly distributed.

Medullary rays fine, short. *Annual rings* marked by a belt of more numerous pores.

Wild in the Punjab from the Indus to the Ravi; much cultivated in the Punjab, Kashmir, Baluchistan, etc.; Europe.

Stewart says this is the handsomest species, and that he has seen it as large as 5 or 6 ft. in girth and 25 to 30 ft. high. The fruit is eaten. Mathieu gives the weight at 60 to 70 lbs. per cubic foot.

		lbs.
P 885.	Multán, Punjab (Baden-Powell)	48
	Nordlinger's Sections, vol. 2.	

5. Z. oxyphylla, Edgw.; Fl. Br. Ind. i. 634; Brandis For. Fl. 86. Vern. *Kúrkun bér*, Afgh.; *Pitni, kokan ber, amlái, amnia, beri, shamor*, Pb.; *Giggar*, N.-W. Provinces.

A thorny shrub. *Bark* thin, brown, rough with prominent vertical lenticels. *Wood* white, moderately hard. *Pores* small, scanty, somewhat larger and more numerous on the inner edge of each annual ring. *Medullary rays* equidistant, very fine; the distance between the rays equal to the diameter of the pores. Faint concentric lines occasionally joining the pores.

Outer Himalaya from the Indus to the Ganges at 2–6000 ft.

A very pretty shrub, with a bright orange-coloured small fruit, which is eaten and tastes like tamarinds. It is described as black; perhaps it turns black as it gets past ripeness, but I have not seen it so.

		lbs.
H 2949.	Suni, Sutlej Valley, 3000 ft. (Gamble)	—
H 4818.	Tiuni, Jaunsar, 3000 ft. "	44

6. Z. Œnoplia, Mill.; Fl. Br. Ind. i. 634; Bedd. Fl. Sylv. lxix.; Brandis For. Fl. 86; Kurz For. Fl. i. 266; Talbot Bomb. List 52; Trimen Ceyl. Fl. i. 280. *Z. Napeca*, Roxb. Fl. Ind. i. 612; Vern. *Makoh, makai*, Hind.; *Shyakúl*, Beng.; *Barokoli, kontai koli*, Uriya; *Irún*, C.P.; *Mahkoa*, Monghyr; *Makor*, Berar; *Paramu, paramie, pariki, porki*, Tel.; *Tawzinwè, sudauk*, Burm.

A straggling or climbing shrub with rough, grey or grey-brown *bark* with occasional thorns. *Wood* reddish, with the structure of a climber. *Pores* moderate-sized to large, often subdivided, between closely packed *medullary rays*, which bend outwards where they touch the pores.

All the drier and some of the moist regions of India; from the foot of the Himalaya and the Siwaliks, eastwards to Nepal; Assam, Sylhet and Chittagong; all over Burma and in the Andaman Islands; West and South India and Ceylon.

A very troublesome climbing plant covered with small but very strong thorns, difficult to cut and troublesome to passers-by along the roads. It prefers open bushy places to the regular forests. It is much used for making fences for fields; and the fruit, which is black, about as big as a pea, is eaten and has a pleasant acid taste. The seeds are sometimes made into rosaries.

C 2753. Moharli Reserve, C.P. (Brandis).
C 4346. Mojagodo, Ganjam (Gamble).

7. Z. xylopyra, Willd.; Fl. Br. Ind. i. 634; Roxb. Fl. Ind. i. 611; Bedd. Fl. Sylv. lxviii.; Brandis For. Fl. 90; Talbot Bomb. List 52; Trimen Fl. Ceyl. 282. Vern. *Kat-ber, béri, goti, gotaha, kakor, chittania, sitabér, ghónt*, Hind.; *Goti*, Tel; *Goti, bhorgoti*, Mar.; *Ghota*, Melghát; *Challe, mullu kare*, Kan.; *Ghatbor*, Berar; *Karkata*, Kol; *Goit*, Bhumij; *Kankor*, Kharwar; *Got, goto, gotoboro, kanta bohul*, Uriya; *Ghattól, ghotia*, Gondi; *Karkat*, Sonthal; *Ghont*, Mal Pahari, Monghyr; *Kotori*, Khond; *Goté*, Palkonda; *Kottei, nari-ilantai*, Tam.; *Kotta*, Mal.; *Kakuru*, Cingh.

A small tree. *Bark* grey or reddish-brown, with thick oblong exfoliating scales. *Wood* reddish- or yellowish-brown with a small

dark-coloured centre, hard. *Pores* small and moderate-sized, in patches of soft tissue which are often confluent, forming oblique bands. *Medullary rays* fine, equidistant, very numerous, the distance between the rays less than the transverse diameter of the pores. *Annual rings* not prominent.

Sub-Himalayan and Siwalik forests from the Jumna eastwards, ascending to 3000 ft.; Rajputana, the C.P., Chota Nagpore, Orissa, the Circars, Deccan and Carnatic; Western coast from the Konkan to Travancore; dry country of Ceylon.

A common small tree in the deciduous forests, often with *Z. Jujuba*. The wood is not as good as that of *Z. Jujuba*, but it is used for carts, agricultural implements, firewood and charcoal. Skinner, No. 136, gives W = 60 lbs., P = 800; the specimens give W = 50. The fruit is not edible, but is used in tanning to give a black dye to leather. In some parts of the C.P. it is the chief tree to give lac.

		lbs.
O 4735.	Kasumri Forest, Saharanpur (Gradon)	46
C 2736.	Moharli Reserve, C.P. (Brandis)	49
C 2764.	Melghát, Berar (Brandis)	—
C 3433.	Palamow Forests, Chota Nagpore (Gamble)	—
C 3508, 3559.	Khurdha Forests, Orissa "	53
D 4228.	Cuddapah (Higgens)	54

8. Z. rugosa, Lam.; Fl. Br. Ind. i. 636; Bedd. Fl. Sylv. lxvii.; Brandis For. Fl. 89; Kurz For. Fl. i. 265; Gamble Darj. List 19. *Z. latifolia*, Roxb. Fl. Ind. i. 607. Vern. *Bhand ber*, Dehra Dún; *Dhaura, dhauri, makoi*, Oudh; *Suran, churna*, C.P.; *Turan*, Mar.; *Rukh baer, harray baer*, Nep.; *Sekra*, Sonthal; *Hohnoi*, Mal Pahari; *Sana gadu*, Khond; *Chúrni, sokria*, Berar; *Thodali*, Mal.; *Chunu koli*, Uriya; *Churai*, Tam.; *Maha-eraminiya*, Cingh.; *Myaukzi*, Burm.

A large scrambling shrub or small evergreen tree. *Bark* rough, dark. *Wood* reddish, moderately hard. *Pores* large and moderate-sized, oval and subdivided. *Medullary rays* fine, extremely numerous, uniform and equidistant, the distance between the rays much less than the transverse diameter of the pores. Pores frequently joined by very faint, wavy, concentric lines.

Valleys and lower hills of the N.-W. Himalaya and sub-Himalayan forests, up to 3000 ft., from the Jumna eastwards (perhaps from the Sutlej), common in Sikkim; Assam, Sylhet and all over Burma; Central and Western and South India, ascending in the Nilgiris to nearly 6000 ft.

A troublesome thorny climber of no use; the wood is used for fuel, and the fruit said to be eaten, but I imagine it is rather too dry.

		lbs.
E 2336.	Bamunpokri, Darjeeling Terai (Gamble)	45

4. BERCHEMIA, Neck.

A genus which, besides this species, contains about five erect or climbing shrubs, of which the chief is *B. lineata*, DC; Fl. Br. Ind. i. 638; Brandis For. Fl. 91, of the North-West Himalaya, a very pretty small shrub often found on rocks at about 7000 ft.

1. B. floribunda, Brongn.; Fl. Br. Ind. i. 637; Brandis For. Fl. 91; Kurz For. Fl. i. 264; Gamble Darj. List 19. Vern. *Kouloi*, Jaunsar; *Amili*, Garhwal; *Kala lag*, Kumaon; *Chiaduk*, Nep.; *Rungyeong rik*, Lepcha.

A large climbing shrub. *Bark* whitish, exfoliating and showing a purple inner layer. *Wood* yellow, turning grey on exposure, porous. *Pores* large, oval, subdivided, between undulating moderately broad *medullary rays*.

Himalaya and sub-Himalayan tract from the Jhelum to Bhutan, rising to 6000 ft.; not uncommon in the Dehra Dún; Khasia Hills; hills of Upper Burma. A pretty climber, usually found in swampy places or moist valleys.

E 2864. Tukdah, Darjeeling, 5000 ft. (Gamble).

5. RHAMNUS, Linn.

Contains eight species, found in the Himalaya and the mountains of the Western Coast and Ceylon. *R. Arnottianus*, Gardn.; Fl. Br. Ind. i. 638; Trimen Ceyl. For. i. 283, is a small tree of the higher hills of Ceylon, especially round Newera Ellia. There are several species in Europe, with similar curious wood-structure.

Wood generally with a brown heartwood, close-grained. *Pores* very small, arranged in oblique patches which generally anastomoze, or marking the *annual rings*. *Medullary rays* fine, numerous.

Mathieu describes the pores thus: "*Pores* fine, equal, grouped together in great 'numbers and forming, in the inner edge of each ring, a broader or narrower belt from 'which run undulating, branching and radiating lines, which on a transverse section 'produce an elegant and remarkable reticulated design, of lighter colour than the rest 'of the wood" (Fl. For. 67).

1. **R. virgatus**, Roxb. Fl. Ind. i. 604; Brandis For. Fl. 92; Gamble Darj. List 19. *R. dahuricus*, Pall.; Fl. Br. Ind. i. 639. *R. hirsutus*, W. and A.; Bedd. Fl. Sylv. lxx. Vern. *Phipai, dúdár, tadru, seta pajja, kánji, mamrál, shomfol, reteon, gogsa, sindrol, mútni, nior, chatr, romúsk*, Pb.; *Thalot, chetain*, Simla; *Tsápo, mail*, Tibet, Spiti; *Chato, chedwala, chadua*, Hind.; *Chaurdhu, chandúl, charyúlo*, Kumaon; *Chhendula, chkithula*, Garhwal; *Thanthár*, Dehra Dún.

A shrub or small tree, deciduous. *Bark* thin, grey to black, peeling off in small square flakes, smooth. *Wood* very hard, close-grained; sapwood whitish; heartwood brown. *Annual rings* distinctly marked. *Pores* very small, arranged in oblique anastomozing irregular patches of soft texture, forming an irregular network. *Medullary rays* fine, very numerous, prominent in the meshes of the network.

Throughout the Himalaya and Western Ghâts, in forest undergrowth.

Weight, 58 lbs. per cubic foot. Wood not used, except as firewood. The fruit is bitter, emetic and purgative, and is given in affections of the spleen.

			lbs.
H	79.	Mashobra, Simla, 7000 ft.	57
H	2877.	Nagkanda, Simla, 8000 ft. (Gamble)	55
H	3168.	Dungagalli, Hazara, 7000 ft. (Wild)	—
H	4780.	Balcha, Tehri-Garhwal, 9000 ft. (Gamble)	66
W	4045.	Lovedale, Ootacamund, 7000 ft. "	56
		Nordlinger's Sections, vol. 8.	

The S. Indian plant seems to be a different species to that of N. India, and I think the retention of *R. hirsutus* as a species may prove desirable. The wood of *R. dahuricus*, Pall., as shown in Nordlinger's Sections, vol. 3, is different, having much larger pores not arranged in a network of light tissue.

2. **R. persicus**, Boissier; Fl. Br. Ind. i. 638; Brandis For. Fl. 93. Vern. *Sherawane, warak*, Afgh.; *Kukei, nar, nikki kander, jalidar, kuchni*, Pb.; *Charyula*, Kumaon; *Chhetulo*, Garhwal; *Chirla*, Dehra Dún.

A small deciduous tree. *Bark* thin, very dark ashy brown, rough, peeling off in small rounded flakes. *Wood* hard, close-grained; heartwood yellowish-brown, the grain "water-marked" on vertical sections. *Pores* very small to small, arranged in an irregular branching reticulate

pattern amid patches of soft tissue. ***Medullary rays*** **fine, very short, very numerous and regular.**

Suliman and Salt Ranges; Himalaya, from the Jhelum to Garhwal, at 2–5000 ft.

A beautiful wood, much resembling that of *R. triqueter*, and with it probably the best in the genus. It would make very pretty turnery articles.

		lbs.
O 5004.	Dehra Dún (Milward)	58

3. **R. Wightii,** W. and A.; Fl. Br. Ind. i. 639; Bedd. Fl. Sylv. lxx.; Talbot Bomb. List 52; Trimen Fl. Ceyl. i. 283.

A large shrub. *Bark* brown, with scattered corky diamond-shaped lenticels. *Wood* yellowish-brown, moderately hard, close-grained. *Pores* very small and small, arranged in narrow irregular radial and oblique patches of soft tissue which often anastomoze. *Annual rings* marked by a belt of larger pores. *Medullary rays* fine, close.

Hills of Southern India and Ceylon, from the Circars (Mahendragiri Hill, 4000 ft.) and Konkan southwards, and up to 7000 ft.

D. Hooper says the bark is exported to Bombay under the name of "*Rakta rohida*," and gives a drug similar to Cascara.

W 3745. Coonoor, Nilgiris, 6000 ft. (Gamble).
W 4093. Fairlawns Shola, Ootacamund, 7000 ft. (Gamble).

4. **R. purpureus,** Edgew.; Fl. Br. Ind. i. 639; Brandis For. Fl. 91. Vern. *Bat sinjal, tunani zanani, tadra, tundhi, mimarari, kunji, chaterni*, Pb.; *Luhish, lhish.* Jaunsar; *Payán*, Kumaon; *Bakauro, banáru*, Garhwal.

A large deciduous shrub. *Bark* thin, greyish-brown, marked with short black vertical lines. *Wood* brownish-grey, close-grained, heartwood red. *Annual rings* marked by an interrupted belt of pores. *Pores* very small, in narrow irregular oblique patches of soft tissue, which anastomoze and have a reticulate appearance. *Medullary rays* fine, numerous, straight, prominent.

North-West Himalaya from the Indus to Nepal, between 4500 and 10,000 ft.

The fruit is used as a purgative. Both this species and *R. virgatus* are host-plants of the cereal rust, *Puccinia coronata*, Corda, the æcidial form appearing on various grasses.

		lbs.
H 70.	Mashobra, Simla, 7000 ft.	41
H 2848.	Mahasu, Simla, 8000 ft. (Gamble)	—
H 4707, 4418.	Jaunsar Forests, N.-W. Provinces (Gamble)	40

5. **R. triqueter,** Wall.; Fl. Br. Ind. i. 639; Brandis For. Fl. 92. Vern. *Gudlei*, Simla; *Fagora, gardhan, phulla*, Pb.; *Gogsa, ghant*, N.-W. Provinces; *Katheru*, Jaunsar.

A small tree, deciduous. *Bark* thin, grey. *Wood* yellowish-brown, hard, close-grained. *Annual rings* distinctly marked by an interrupted belt of large pores. *Pores* very small to small, arranged in irregular branching patches of soft tissue, which anastomoze, giving an irregular pattern. *Medullary rays* fine and moderately broad, short.

North-West Himalaya from the Jhelum to Nepal, at 3–6000 ft., common about Mussoorie and in the Tons Valley.

This species gives a handsome wood of an olive-brown colour, which would be useful for turning and small carving.

		lbs.
H 75.	Mashobra, Simla, 7000 ft.	—
H 2903.	Nagkanda, Simla, 8000 ft. (Gamble)	—
H 4808.	Tiuni, Jaunsar, 3000 ft. "	56

Nordlinger's Sections, vol. 8 (Tab. IV. 4).

6. **R. nepalensis,** Wall.; Fl. Br. Ind. i. 640; Gamble Darj. List 19. Vern. *Achal*, Nep.

A large shrub. *Bark* dark brown, rough. *Wood* brownish-grey, moderately hard. *Pores* very small to small, arranged in oblique anastomozing patches, and sometimes in softer whitish tissue. *Medullary rays* fine and moderately broad, short.

Central and Eastern Himalaya, ascending to 6000 ft.; Khasia Hills; Kachin Hills of Burma.

E 3346. Kalimpúng, Darjeeling, 4000 ft. (Gamble).
E 3364. Dhupguri, W. Dúars (Gamble).

7. **R. procumbens,** Edgew.; Fl. Br. Ind. i. 640; Brandis For. Fl. 93.

A small procumbent shrub, climbing over rocks. *Wood* yellowish, structure the same as that of *R. virgatus.*

Western Himalaya from Simla to Kumaon, at 7–8000 ft., especially on limestone.

H 2952. Naldehra, Simla, 7000 ft. (Gamble).

6. HOVENIA, Thunb.

1. **H. dulcis,** Thunb.; Fl. Br. Ind. i. 640; Roxb. Fl. Ind. i. 630; Brandis For. Fl. 94. The Coral tree. Vern. *Chamhún*, Ravi; *Sicka*, Hind.

A tree. *Bark* greyish-brown. *Wood* light yellowish-brown, soft. *Pores* moderate-sized to large, often subdivided, evenly scattered. *Medullary rays* fine, numerous, bent where they touch the pores, or starting from them. *Annual rings* prominent.

Valleys of the North-West Himalaya, common in those on the north side of the Tons river in Tehri-Garhwal at 3–5000 ft. (*e.g.* Mora, Salla and Mautar-gadhs), also about Mussoorie. Much cultivated in the Punjab Himalaya, also in Nepal.

In suitable places it grows to be a large handsome tree, but the wood is not used. The fruit is eaten, the part eaten being the enlarged fleshy peduncles.

Nordlinger's Sections, vol. 7.

7. SCUTIA, Comm.

1. **S. indica,** Brongn.; Fl. Br. Ind. i. 640; Bedd. Fl. Sylv. lxx.; Kurz For. Fl. i. 268; Talbot Bomb. List 53; Trimen Fl. Ceyl. i. 284. *Rhamnus circumscissus*, Roxb. Fl. Ind. i. 604. Vern. *Gariki*, Tel.; *Chimat*, Bombay; *Tuvadi*, Tam.

A straggling thorny shrub. *Bark* brown, rough, somewhat corky. *Wood* light reddish-brown, hard, close-grained. *Pores* moderate-sized, single or in short radial lines of 2 to 4. *Medullary rays* fine, very numerous, short, the distance between them less than the diameter of the pores, round which they bend.

South India from the Circars through the Deccan and Carnatic, ascending to 6000 ft. on the east side of the Nilgiris; Western India from the Konkan through the Supa Ghâts of N. Kanara; dry country of Ceylon; Attaran valley in Burma.

A very thorny plant, troublesome to penetrate, used for hedges. Dr. T. Cooke says it is called "Wait-a-bit thorn" at Mahabaleshwar.

D 4255. Striharikota forests, Nellore (Gamble).

8. SAGERETIA, Brongn.

Five species, erect or straggling shrubs. *S. hamosa*, Brongn.; Fl. Br. Ind. i. 641, is a large straggling shrub of the Himalaya (Dehra Dún, 3000 ft.), N. Circars (Mahendragiri, 3000 ft.) and the hills of South India, such as the Nilgiris and Pulneys, armed

with long recurved thorns. *S. costata*, Miq.; Trimen Fl. Ceyl. i. 284, is a straggling shrub of the Ceylon hills.

Wood close-grained, hard. *Pores* small, round. *Medullary rays* fine and very fine. *S. oppositifolia* has a more open structure, with larger pores and broader medullary rays.

1. **S. oppositifolia**, Brongn.; Fl. Br. Ind. i. 641; Brandis For. Fl. 95; Talbot Bomb. List 53. Vern. *Kanak*, *gidárdák*, *drange*, *girthan*, Pb.; *Aglaia*, Kumaon; *Gonta*, E. Dún.

A large, usually straggling or climbing shrub. *Bark* grey, smooth, peeling off in thin flakes and leaving the cinnamon-brown under-bark exposed. *Wood* moderately hard to hard, sapwood white, heartwood pink. *Annual rings* marked by white lines. *Pores* round, moderate-sized, often subdivided and surrounded by white rings. *Medullary rays* fine to moderately broad, numerous. Structure more open than that of the other two species.

North-West Himalaya from the Indus to Kumaon at 2–6000 ft.; Konkan.

This straggling shrub is conspicuous below Mussoorie; it has a sweetish edible fruit.

H 4841. Jharipani, Mussoorie, 4500 ft. (U. N. Kanjilal).

2. **S. theezans**, Brongn.; Fl. Br. Ind. i. 641; Brandis For. Fl. 95; Kurz For. Fl. i. 267. Vern. *Dargola*, Simla; *Drangu*, *ankol*, *kauli*, *karúr*, *phomphli*, *kánda*, *brinkol*, *chaunsh*, *katráin*, *thúm*, *kúm*, Pb.

A large spinescent shrub. *Bark* thin, grey. *Wood* very hard, white, with irregular dark-coloured heartwood. *Annual rings* (?) marked by white lines. *Pores* round, small, in rings of soft texture, uniformly distributed. *Medullary rays* fine and very fine, numerous.

Salt Range and Suliman Range; Western Himalaya from Kashmir to Simla, at 3–8000 ft.; Upper Burma. Fruit eaten.

			lbs.
H 2946.	Suni, Sutlej Valley, 3500 ft.	(Gamble)	—
H 2951.	Naldehra, Simla, 7000 ft.	,,	—
H 3129.	Koti, Simla, 6000 ft.	,,	56

3. **S. Brandrethiana**, Aitch.; Fl. Br. Ind. i. 642; Brandis For. Fl. 95. Vern. *Ganger*, *goher*, Pb.; *Maimúna*, Afg.

A small deciduous shrub. *Bark* grey, with long wrinkles. *Wood* light-brown or yellow, hard, close-grained. *Pores* small, round, numerous, between the fine, short, very numerous *medullary rays*.

Suliman Range and Salt Range, and North-West Himalaya between the Indus and the Jhelum.

The fruit is sweet and much eaten by Afghans and in the frontier districts.

P 914. Salt Range, Punjab (Baden-Powell).
Nordlinger's Sections, vol. 10.

9. COLUBRINA, Rich.

Three species. *C. pubescens*, Kurz For. Fl. i. 269; Fl. Br. Ind. i. 642, is a large straggling shrub of open forests all over Burma. *C. travancorica*, Bedd.; Fl. Br. Ind. i. 643, is found in Travancore.

1. **C. asiatica**, Brongn.; Fl. Br. Ind. i. 642; Kurz For. Fl. i. 268; Bedd. Fl. Sylv. lxix.; Talbot Bomb. List 53; Trimen Fl. Ceyl. i. 285. *Ceanothus asiaticus*, Roxb. Fl.

Ind. i. 615. Vern. *Guti*, Mar.; *Mayirmanikkan*, Tam.; *Tel-hiriya*, Cingh.; *Kwenwè*, Burm.

A shrub or small tree. *Bark* thin, greyish-white, slightly rough. *Wood* hard; sapwood white, heartwood orange-pink, satiny. *Pores* moderate-sized to large, prominent, often subdivided, thick-walled. *Medullary rays* fine to moderately broad, prominent; silver-grain of fine plates.

Coast forests of South India, Burma, the Andamans and Ceylon.
Singapore—Kew Museum (Ridley).

10. APTERON, Kurz. *A. lanceolatum*, Kurz; Fl. Br. Ind. i. 643; Kurz For. Fl. i. 623, is a large scandent shrub, common in the tropical forests of the eastern side of the Pegu Yoma and in Upper Tenasserim.

11. GOUANIA, Linn.

Four species, climbing shrubs. *G. microcarpa*, DC; Fl. Br. Ind. i. 643; Brandis For. Fl. 574; Talbot Bomb. List 53; Trimen Fl. Ceyl. i. 286, is found in S. India and Ceyl.; *G. Brandisii*, Hassk.; Kurz For. Fl. i. 270, in Martaban and Tenasserim; and *G. nepalensis*, Wall., in the Central Himalaya.

1. G. leptostachya, DC; Fl. Br. Ind. i. 643; Brandis For. Fl. 574; Kurz For. Fl. i. 269; Gamble Darj. List 19. Vern. *Kalalag*, Kumaon; *Batwasi*, Nep.; *Tungcheong*, Lepcha; *Khanta*, Uriya; *Tayawnyonwè*, Burm.

A large climbing shrub. *Bark* rough, brown, ¼ in. thick. *Wood* brown, soft. *Pores* large, very numerous. *Medullary rays* broad.

Sub-Himalayan tract and lower hills from the Jumna eastwards (common in Dehra Dún and Darjeeling); Assam and Khasia Hills; all over Burma; Chota Nagpore and Orissa.

E 3430. Darjeeling Hills, 6500 ft. (Gamble).

12. HELINUS, E. Meyer. *H. lanceolatus*, Brandis in For. Fl. 574; Fl. Br. Ind. i. 644, is an unarmed, scandent, cirrhose plant, scarcely reaching woody size, but very common and often covering trees and bushes very largely in the sub-Himalayan region from the Punjab to Nepal and up to 4000 feet. It is very common in the Dehra Dún and on the Siwaliks. It is also found in the higher hills of Chota Nagpore as at Neturhát in Palamow and in Saranda.

ORDER XXXV. AMPELIDEÆ.

Two genera, Vitis and Leea, containing more or less woody plants. Since the publication of the Fl. Br. Ind., the whole Order has been the subject of a Monograph by J. E. Planchon in vol. v. of De Candolle's "Monographiæ Phanerogamarum"; Kurz has also written his "Forest Flora of British Burma," and other botanists have discussed the family, especially Sir G. King in his papers in the *Journ. of the As. Soc. Beng.* Nearly all the species of *Vitis* are climbers, those of *Leea* large soft shrubs or small trees. The "woody" species of *Vitis* seem to be about 28, those of *Leea* about 6.

1. VITIS, Linn.

From 60 to 70 species of climbing or semi-erect shrubs with soft porous wood, only a few being of interest to the Indian Forest officer, and that interest chiefly reduced to a desire to cut them, to free the trees upon which they climb from their constricting stems or the weight of their hanging branches. *V. quadrangularis*, Wall., is a vine with 4-angled fleshy stems common in the dry regions of India and Ceylon. *V. discolor*, Dalz. is a climber of the Sikkim Himalaya, Eastern Bengal and Burma, with pretty velvety blotched red and white and green leaves, often cultivated for

ornament. *V. lanata*, Roxb. (E 484, Darjeeling Terai; *V. repanda*, W. and A. (E 485, Darjeeling Terai; C 4341, Ganjam Forests); and *V. latifolia*, Roxb., are soft-wooded climbers of the Indian Sál and other forests with corky *bark*, very large *pores* and broad *medullary rays*. *V. lanceolaria*, Wall., is a large pedate-leaved climber of Northern Bengal, Assam, Burma and South India, extending, but scarce, along the Himalaya to the Debra Dún, with flattened stems. The Grape Vine, *V. vinifera*, Linn.; Vern. *Dákh*, *dakki*, *dráksha*, *angúr*, Hind.; *Lanang*, Kunawar; *Sabyit*, Burm., has been introduced and successfully cultivated in Kashmir and other parts of India; it has the usual structure of very large *pores* and very broad *medullary rays*, and the wood is rather harder than that of most kinds (Nordlinger's Sections, vol. 1). The big climbers contain much watery sap, which flows out readily from a cut end when another cut is made a little above, and is by no means unpleasant for a thirsty person in hot dry weather.

1. V. semicordata, Wall., var. *Roylei*, King in Journ. As. Soc. Beng. lxv. ii. 7 and 683. *V. himalayana*, Brandis For. Fl. 100; Fl. Br. Ind. i. 655; Kurz For. Fl. i. 273; Gamble Darj. List 20. Vern. *Chappar tang*, *tipti*, Kumaon; *Phlankur*, Simla; *Zemardachan*, *zemaro*, Sutlej; *Kandár*, Jaunsar; *Philuna*, Garhwal; *Bara churcheri*, Nep.; *Hlotagbret*, Lepcha.

A large climber, often 6 in. or more in diameter. *Bark* dark brown, thick, fibrous, marked by longitudinal rings and vertical clefts, peeling off in fibrous strings. *Wood* rather hard, dark brown, with large pith and conspicuous concentric (? annual) rings. *Pores* in the concentric rings large, in the rest of the wood small. *Medullary rays* broad, long and deep, forming a very good silver-grain.

Himalaya from Kashmir to Sikkim, usually at from 6–10,000 ft.; Khasia Hills; Nilgiris and Pulneys and other hills of S. India; hills of Martaban, E. of Toungoo in Burma.

This and the ivy are the only climbers of any consequence in the Upper Himalayan forests, requiring to be cut and destroyed. It is often called "Virginia creeper," and it much resembles that well-known plant (*Vitis* (*Ampelopsis*) *quinquefolia*) of N. America, when, in autumn, the spruce and silver fir trees are draped with its branches and leaves of every tint, from green through yellow and orange to scarlet and crimson. The wood is good, strong and pretty (I have a picture-frame made of its wood, cut so as to show the silver-grain to advantage, and it is quite handsome), but it requires long seasoning. The weight varies considerably.

	lbs.
H 44, 2913. Simla, 7000 ft. (Gamble)	33
H 4802. Konain Forest, Jaunsar, 8000 ft. (Gamble)	52
Nordlinger's Sections, vol. 9.	

2. V. pallida, W. and A.; Fl. Br. Ind. i. 647; Talbot Bomb. List 55.

A large erect or straggling shrub. *Bark* brown, in parts smooth, in parts rough, corky. *Wood* reddish-brown, soft. *Pores* small to large, very scanty, scattered in the cellular tissue between the very broad, red, pithy *medullary rays*.

Dry regions of the Deccan, rather conspicuous on rocky dry hills.

D 3887. Nigadi Hills, Cuddapah, 2000 ft. (Gamble).

3. V. planicaulis, Hook. f.; Fl. Br. Ind. i. 658.

A large climbing shrub with flattened stems. *Bark* light-brown, ¼ in. thick, with prominent rough lenticels. *Wood* soft, brown when dry, porous, in layers at either end of a narrow, flattened, undulating-edged stem, the layers bounded by bands of bast tissue. *Pores* very large to extremely large. *Medullary rays* many moderately broad, occasional ones very or extremely broad.

Sikkim Himalaya and Khasia Hills at 3–4000 ft.

In the Fl. Br. Ind. this is described as "a vast climber, reaching to the top of the highest trees and sending down from its branches long, thin, leafless bands."
Sikkim Hills—Kew Museum (J. D. Hooker).

2. LEEA, Linn.

The species of Leea are found in the undergrowth of the forests, and one or two also in open grass-lands like the large-leaved *L. macrophylla*, Roxb., and the red-flowered *L. alata*, Edgw. Among the forest ones, *L. aspera*, Wall., is very common in deciduous forests all over India, from the Dún down; *L. crispa*, Willd., is similarly common in the Darjeeling Terai; where also occurs the larger *L. sambucina*, Willd.

1. **L. robusta,** Roxb. Fl. Ind. i. 655; Fl. Br. Ind. i. 667; Gamble Darj. List 21; Talbot Bomb. List 57. Vern. *Galeni*, Nep.; *Pantóm*, Lepcha.

A large shrub. Stem fluted, with very large pith. *Bark* smooth, grey, striped. *Wood* moderately hard, brown. *Pores* small. *Medullary rays* broad.

Sikkim Himalaya and Khasia Hills up to 5000 ft.; N. Circars; West Coast, in N. Kanara.

A handsome plant; wood used for fencing and temporary huts in the Darjeeling Terai.

E 879, 2860. Bamunpokri, Darjeeling Terai.

2. **L. umbraculifera,** C. B. Clarke; Gamble Darj. List 21. Vern. *Galeni*, Nep.

A small tree. *Wood* greyish-brown, moderately hard. *Pores* small, radially distributed. *Medullary rays* of two kinds, very broad and fine.

Forests of the Sikkim Himalaya, Terai and Dúars, up to 3000 ft., in the undergrowth of evergreen forests. Also, perhaps, in N. Circars.

E 3278. Muraghát Reserve, W. Dúars (Gamble).

ORDER XXXVI. SAPINDACEÆ.

An Order of about 23 genera coming within the limits of this work, some of them containing trees of great importance in Indian Forest economy. *Æsculus*, *Acer*, and *Staphylea* belong almost entirely to the cold climate of the Himalaya and its offshoot ranges; *Stocksia* and *Dodonæa* belong to the dry regions; *Schleichera* is an important forest tree of the great deciduous forests, but most of the rest are from hot tropical climates in S. India and Burma. Several species give useful timbers; others some of the best fruits of the East; others again articles of minor produce in considerable demand. The nomenclature of the genera is somewhat confusing, the Gen. Plantarum, the Fl. Br. Ind., Beddome, Kurz, Trimen and finally King all taking more or less different views of their limits, especially in *Cupania*, *Ratonia*, *Nephelium* and *Sapindus*. Under these circumstances, I have thought it best to adhere as closely as possible to the Gen. Plantarum. The Order is divided into four Tribes, viz.—

Tribe I. Sapindeæ . .	Hemigyrosa, Dittelasma, Erioglossum, Allophylus, Stocksia, Æsculus, Scyphopetalum, Cupania, Paranephelium, Lepisanthes, Schleichera, Glenica, Sapindus, Xerospermum, Nephelium, Pometia, Harpullia, Zollingeria.
„ II. Acerineæ . .	Acer, Dobinea.
„ III. Dodonæeæ . .	Dodonæa.
„ IV. Staphyleæ . .	Staphylea, Turpinia.

***Blighia sapida*, Kön. the *Akee* fruit, has been occasionally cultivated in Indian gardens.**

Wood generally soft or moderately hard, even-grained, sometimes hard; no distinct heartwood except in *Schleichera*, *Nephelium* and *Dodonæa*. *Pores* small or very small, generally uniform and uniformly distributed. *Medullary rays* very fine or fine, rarely moderately broad, often closely packed. Apart from the *annual rings*, concentric bands occur in *Sapindus* and some other genera, but not in all.

TRIBE I. SAPINDEÆ.

1. HEMIGYROSA, Blume.

Two species. *H. deficiens*, Bedd. Fl. Sylv. t. 231; Fl. Br. Ind. i. 671 (*Anomosanthes deficiens*, Bl.; Bedd. Fl. Sylv. lxxii.), is a tree of the hills of South India, found especially in the Anamalais at 2–5000 ft. and in the Tinnevelly Gháts.

1. H. canescens, Thw.; Fl. Br. Ind. i. 671; Bedd. Fl. Sylv. t. 151; Kurz For. Fl. i. 290; Talbot Bomb. List 58; Trimen Fl. Ceyl. i. 301 (*Molinæa canescens*, Roxb. Fl. Ind. ii. 243). Vern. *Nekota*, *karadipongan*, Tam.; *Korivi*, Tel.; *Kalú yette*, *kurpah*, Kan.; *Kurpa*, *lakhandi*, *lokaneli*, Mar.; *Eskombo*, Khond.

A tree. *Wood* white, hard, close-grained, with very numerous, very prominent wavy white concentric bands and concentrically arranged patches, about 70 to the inch. *Pores* moderate-sized, scanty, often subdivided. *Medullary rays* extremely fine, regular and regularly distributed.

Forests of the East Coast from the N. Circars southwards; moist forests of the Western Gháts from the Konkan to Tinnevelly; low country of Ceylon; Tenasserim in Burma.

Beddome says the wood is occasionally used for building.

		lbs.
D 3981.	Agri-Horticultural Gardens, Madras (Steavenson)	54

2. DITTELASMA, Hook. f. *D. Rarak*, Hook. f.; Fl. Br. Ind. i. 672; Kurz For. Fl. i. 297, is an evergreen tree of the Pegu Yoma forests and of Tenasserim, sometimes cultivated in Ceylon, and giving a berry which is used for soap, and called *Penela*, Cingh.

3. ERIOGLOSSUM, Blume.

1. E. edule, Blume; Fl. Br. Ind. i. 672; Talbot Bomb. List 58. *E. rubiginosum*, Bl.; Brandis For. Fl. 108. *Pancovia rubiginosa*, Baill.; Kurz For. Fl. i. 296; Bedd. Fl. Sylv. lxxiii. *Sapindus rubiginosa*, Roxb. Fl. Ind. ii. 282. Vern. *Ritha*, Hind.; *Ishi rashi*, Tel.; *Manipangam*, Tam.

A large tree. *Wood* grey (with pinkish-brown heartwood (Kurz)), soft, with alternate wavy concentric bands of soft and hard texture. *Pores* moderate-sized, scanty, often subdivided, uniformly distributed. *Medullary rays* very fine, very numerous, wavy, the distance between them much less than the diameter of the pores.

Oudh forests; Eastern Bengal; Northern Circars; Burma and the Andaman, Nicobar and Coco Islands; often planted for ornament.

Our specimen is small and poor, so that the wood is not quite representative. Roxburgh says it is chocolate-coloured towards the centre.

		lbs.
O 4662.	Oudh (Pandit Keshavanand)	34

4. ALLOPHYLUS, Linn.

Two species, both extremely variable. *A. Cobbe*, Bl. has trifoliate, *A. zeylanicus*, Linn. unifoliate, leaves. *A. zeylanicus*, Linn.; Fl. Br. Ind. i. 673; Gamble Darj. List 22; Trimen Fl. Ceyl. i. 302 (also *A. hispidus*, Trin., *Schmidelia hispida*, Thw.; Bedd. Fl. Sylv. t. 152); Vern. *Kantiernyok*, Lepcha; *Wal-kobbé*, Cingh., is a small tree of the Sikkim Himalaya, Assam, Cachar and Ceylon.

1. **A. Cobbe**, Bl.; Fl. Br. Ind. i. 673; Kurz For. Fl. i. 299 (also *A. serratus*, DC and *A. aporeticus*, Kurz); Talbot Bomb. List 58; Trimen Fl. Ceyl. i. 303. *Ornitrophe Cobbe*, Willd.; Roxb. Fl. Ind. ii. 268 (also *O. aporetica*, Roxb. *l.c.* 264, *O. villosa*, Roxb. *l.c.* 265 and *O. glabra*, Roxb. *l.c.* 267). Vern. *Amarai*, Tam.; *Kobbé, bu-kobbé*, Cingh.

A shrub or small tree. *Bark* dark grey, with corky lenticels. *Wood* grey, moderately hard, divided into belts by numerous parallel and equidistant white concentric lines. *Pores* small, scanty, often in radial strings of 3 to 4. *Medullary rays* very fine, very numerous, equidistant, prominent on a radial section.

Eastern Bengal, South India, Burma, the Andaman and Nicobar Islands and Ceylon.

This somewhat gregarious and extremely variable shrub is very common in the undergrowth of forests in the valleys of the hills of S. India, as on the Coonoor ghât in the Nilgiris; also in Ceylon up to 6000 ft.

Trimen, quoting Mr. Nevill, says that the Veddas use the wood for bows, and that the fruit is eaten.

		lbs.
B 1988.	Andaman Islands (Kurz, 1866)	40
W 3752.	Coonor, Nilgiris, 5000 ft. (Gamble)	—

5. STOCKSIA, Benth. *S. brahuica*, Bth.; Hook. f. Ic. Pl. t. 1724; Vern. *Karyhanna*, Baluch., is a stiff spinous shrub of Baluchistan.

6. ÆSCULUS, Linn.

Two species. The Horse-chestnut, indigenous in Asia Minor and Greece, and commonly planted in other parts of Europe and completely naturalized there, is *Æ. Hippocastanum*, Linn.

Wood white, soft to moderately hard. *Annual rings* distinct. *Pores* numerous, small or very small, generally abundant in the spring wood. *Medullary rays* uniform, equidistant, very fine, very numerous.

1. **Æ. indica**, Colebr.; Fl. Br. Ind. i. 675; Brandis For. Fl. 103. The Indian Horse-chestnut. Vern. *Torjaga*, Trans-Indus; *Háne, hanúdún, hán, kishing*, Kashmir; *Gún*, Ravi; *Bankhor, gugu, kanor, pánkar*, Hind.; *Kandar*, Jaunsar; *Pú*, Sutlej; *Pangar*, Kumaon.

A large deciduous tree. *Bark* grey, exfoliating in long flakes, which remain attached at their upper ends and hang down and outwards, having a strange appearance. *Wood* white, with a pinkish tinge, soft, close-grained. *Annual rings* marked by a line, and sometimes by fewer pores in the autumn wood. *Pores* very small, evenly distributed. *Medullary rays* very fine, very numerous.

West Himalaya, from the Indus to Nepal, at 4–10,000 ft. It prefers moist shady valleys, where it grows of large size, *e.g.* Chachpur in Raiengarh, the northern slope of Kedarkanta, the Saras and Moriru valleys in Tehri-Garhwal.

A very handsome, ornamental tree reaching 100 ft. or more in height in suitable places, with perhaps 25 ft. in girth; in appearance it is much like the European species, with similar upright thyrsi of flowers and similar seeds, but the capsule is not

echinate. The wood is used for building, water-troughs, platters, packing-cases and tea-boxes, but most especially for cups, plates and vases to hold butter and ghi. The Tibet drinking-cups are sometimes made of it. The twigs and leaves are lopped for fodder. The fruit is given as food to cattle and goats, and in times of scarcity the embryo is soaked in water and then ground and eaten mixed with flour by the hill people.

		lbs.
H 31.	Matiyána, Simla, 7000 ft.	34
H 166.	Kangra, Punjab (1866)	—
H 936.	Hazara, Punjab (Baden-Powell)	35
H 776.	Kalatop, Punjab, 7000 ft. (Pengelly)	34

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2. **Æ. punduana**, Wall.; Fl. Br. Ind. i. 675; Gamble Darj. List 22. *Æ. assamica*, Griff.; Kurz For. Fl. i. 286. Vern. *Cherinangri*, Nep.; *Kunkirkola, ekuhea*, As.; *Dingri*, Dúars; *Bolnawak*, Gáro; *Segabin*, Burm.

A moderate-sized deciduous tree. *Wood* white, soft, close-grained. *Pores* small, in short radial lines between the very fine, closely packed *medullary rays*. *Annual rings* marked by a faint white line.

Northern Bengal, Khasia Hills, Assam and Tenasserim, ascending to 4000 ft.; also in damp forests in Upper Burma.

Growth moderate, 10 rings per inch of radius. This also is a large handsome tree, not unlike *Æ. indica* in leaves, but the flowers are smaller. It prefers rather wet places in evergreen forests.

		lbs.
E 3139.	Buxa Reserve, Western Dúars (Gamble)	36

7. SCYPHOPETALUM, Hiern. *S. ramiflorum*, Hiern in Fl. Br. Ind. i. 676, is a small tree found by Griffith in hilly woods of the Hookhoom Valley in Burma.

8. CUPANIA, Plum. (including *Ratonia*, DC). About 9 species. They are all included under *Cupania* by Hiern and Kurz, but King has redistributed them (see Journ. As. Soc. Beng., lxv. ii. pp. 443–449) under genera *Guioa*, *Arytera*, *Lepidopetalum* and *Mischocarpus*. *C. pentapetala*, W. and A.; Fl. Br. Ind. i. 678 (*Schleichera pentapetala*, Roxb. Fl. Ind. ii. 275); Vern. *Koipura*, *poorakoi*, Sylhet, is a large tree of the forests of Sylhet; and *C. sumatrana*, Miq.; Fl. Br. Ind. i. 678; Kurz For. Fl. i. 285, is also a Sylhet tree, extending to Burma. *C. glabrata*, Kurz For. Fl. i. 284; Fl. Br. Ind. i. 676 (*Sapindus squamosus*, Roxb. Fl. Ind. ii. 282, *Guioa squamosa*, King), is an evergreen tree rather frequent in tropical forests in Burma. *C. Jackiana*, Hiern in Fl. Br. Ind. i. 678 (*Lepidopetalum Jackianum*, Radlk.; King in Journ. As. Soc. Beng., lxv. ii 735) is a small tree of Car Nicobar Island, whose fruits, as Prain has recently shown, are a favourite food of the big Nicobar pigeon (*Calœnas nicobarica*). *C. fuscidula*, Kurz, *C. adenophylla*, Planch., *C. Helferi*, Hiern and *C. Griffithiana*, Kurz, are all trees of Tenasserim. *C. Lessertiana*, Camb. is an evergreen tree of tropical forests in S. Andaman.

9. PARANEPHELIUM, Miq. *P. xestophyllum*, Miq.; Kurz For. Fl. i. 206, is a small evergreen tree of Upper Tenasserim.

10. LEPISANTHES, Bl. Three species, the chief of which is *L. burmanica*, Kurz For. Fl. i. 291 (*L. montana*, Bl.; Fl. Br. Ind. i. 679, an evergreen Burmese tree with a "white, rather heavy, fibrous but close-grained wood" (Kurz). It is found as far north as Myitkyina.

11. SCHLEICHERA, Willd.

1. **S. trijuga**, Willd.; Fl. Br. Ind. i. 681; Roxb. Fl. Ind. ii. 277; Bedd. Fl. Sylv. t. 119; Brandis For. Fl. 105, t. 20; Kurz For. Fl. i. 289; Talbot Bomb. List 59; Trimen Fl. Ceyl. i. 304. Vern. *Kosum, gausam*, Hind.; *Rusqm, kusumo*, Uriya; *Púskú, maý, roatanga*, Tel.; *Pává, pú, púvan, púvú, kúla, pulachi, zolim-buriki*,

Tam.; *Sagdi, shargadi, sagade, chakota, akota,* Kan.; *Chendala,* Coorg; *Puvatti,* Kaders; *Kassumar, koham, kocham,* Panch Mehals; *Kusumb, koon, kohan, peduman,* Mar.; *Komur, púskú,* Gondi; *Baru,* Kurku, Kól; *Kosengi,* Palkonda; *Púvam,* Mal.; *Gyo,* Burm.; *Cóng, kon,* Cingh.

A large deciduous tree. *Bark* $\frac{1}{3}$ in. thick, grey, exfoliating in small rounded plates of irregular shape and size. *Wood* very hard: sapwood whitish; heartwood light reddish-brown. *Pores* scanty, moderate-sized, often oval and subdivided, often joined by pale, interrupted, wavy, concentric lines. *Medullary rays* very fine, very numerous, wavy, uniform and equidistant, closely packed; the distance between the rays less than the transverse diameter of the pores.

Dry, chiefly deciduous, forests in the greater part of India, Burma and Ceylon, but apparently absent from Bengal and Assam. It is found from the Sutlej to Nepal in the Lower Himalaya, sub-Himalayan tract and Siwaliks up to 3000 ft.; throughout Central India, the East and West Coast regions, the Deccan and Carnatic; in all deciduous forests throughout Burma; and in the low country of Ceylon up to 2000 ft.

An important forest tree, both for its products and for its influence. In some places it is almost gregarious; that is, it forms a considerable portion of the crop (*e.g.* at Kalsi, at the junction of the Tons and Jumna), and it is useful, as it gets its new leaves before the hot season, when their bright red colour renders it conspicuous, and reminds one that the tree is shady when others are leafless and bare. It grows to a considerable size "up to 70 ft. in height and 12 ft. in girth" (Kurz).

The weight and transverse strength of the wood have been determined by the following experiments:—

		Weight in lbs.	Value of P.
Brandis, 1862, No. 22. Burma	found .	70	—
„ 1864, 8 experiments with bars 3′ × 1″ × 1″	„ .	68	1160
Baker, 4 experiments, 1829 „ 7′ × 2″ × 2″	„ .	68	618
Wallich, No. 179 (*Scytalia trijuga*)	„ .	60	—
The specimens examined	„ .	65	—
A. Mendis, Ceylon Collection, No. 47	„ .	57	—

So that the weight may be taken on an average as 68 lbs., and P = 980.

The wood is very strong and durable; it is used for oil and sugar mills, rice-pounders (the best wood for the purpose in S. India), agricultural implements and carts. It seasons well, and takes a good polish. It gives a first-rate firewood and charcoal, and is reckoned by Beddome as one of the most valuable timbers of Madras.

The fruit is often eaten, and the seeds give an oil which is used to burn in S. India and Burma, and is reputed to be the Macassar oil of hairdressers. It is considered the best tree for lac, and the Mirzapore lac grown on it is considered to be the best, the best-lasting, and to give the finest-coloured shell-lac, valued in London at £10 12s. per cwt. (Watt). The fruit is eaten, and the leaves and twigs are lopped for cattle-fodder. Analytical experiments on the ashes showed that in 100 lbs. of steam-dry wood 1·46 lbs. were ash, and that of this ash no less than 69 per cent. consisted of calcium carbonate, 12½ and 11½ per cent. respectively being phosphate of iron, etc., and magnesium carbonate. Only 5½ per cent. were sodium and potassium compounds.

			lbs.
O	206.	Garhwal (1868)	65
O	536.	Dehra Dún (O'Callaghan)	65
C	191.	Mandla, Central Provinces (1870)	66
C	1110.	Ahiri Reserve, Central Provinces (R. Thompson) . . .	66
C	2769.	Melghát, Berar (Brandis)	62
C	3533.	Khurdha Forests, Orissa (Gamble)	65
W	732.	South Kanara (Cherry)	70
B	319.	Burma (1867)	75
B	2515.	„ (Brandis, 1862)	72
No. 47, Ceylon Collection, old; No. 79, new (Mendis), doubtful		. . .	57

12. GLENIEA, Hook. f.

1. **G. zeylanica,** Hook. f.; Fl. Br. Ind. i. 682; Bedd. Fl. Sylv. t. 153; Trimen Fl. Ceyl. i. 305, t. 25. Vern. *Kuma*, Tam.; *Wal-mora*, Cingh.

A moderate-sized tree. *Bark* thin, whitish. *Wood* yellowish-white, like boxwood, hard, close- and even-grained, with numerous very narrow white concentric bands which often anastomoze. *Pores* moderate-sized, often subdivided, scanty, usually in radial or oblique strings. *Medullary rays* fine, numerous, prominent.

Dry region of Ceylon, where common.
Ceylon: Int. Exhn., 1862—Kew Museum.

13. SAPINDUS, Plum.

Seven species, three of which are trees or shrubs endemic in and scarce in Ceylon. The West Indian "Soapberry" is *S. Saponaria*, Linn.

1. **S. emarginatus,** Vahl.; Roxb. Fl. Ind. ii. 279; Bedd. Fl. Sylv. t. 154; Brandis For. Fl. 107; Trimen Fl. Ceyl. i. 307. *S. trifoliatus*, Linn.; Fl. Br. Ind. i. 682; Talbot Bomb. List 59. *S. laurifolius*, Vahl.; Roxb. Fl. Ind. ii. 278; Bedd. Fl. Sylv. lxxiii.; Trimen Fl. Ceyl. i. 306. The Soapnut tree. Vern. *Ritha*, Hind.; *Bara-ritha*, Beng.; *Mukta maya*, Uriya; *Rita*, Mar.; *Konkúdú*, Tel.; *Pounanga, puvandi, ney-koddan, panalai*, Tam.; *Thalay maiathu, aratala, antawála*, Kan.; *Areeta*, Mal.; *Chána, shothali, nitha vanji*, Trav. Hills; *Puvella, penela*, Cingh.

A large tree. *Bark* shining, grey, with rough deciduous scales. *Wood* yellow, hard. *Pores* scanty, moderate-sized, surrounded by patches of light tissue which are joined together in more or less concentric wavy bands, between which are darker bands without pores; the pores often filled with white mineral matter. *Medullary rays* very fine, numerous.

Forests of the drier country of the Deccan and Carnatic, common in Striharikota and other forests, much planted about villages; evergreen forests of the Konkan and Kanara; dry region of Ceylon. The var. *laurifolia* apparently affects moister regions.

The chief produce of this tree is its fruit, which, under the name of "*Ritha*" or "Soapnut," is in universal use for washing as a substitute for soap; in preference to which it is used for some things, like flannel. The wood is very little used, occasionally only for carts and in building. Skinner, No. 114, gives W = 64 lbs., P = 682; Bourdillon gives W = 66 lbs. and P = 725, and he says the wood is used for oil mills. The root, bark and fruit are used in native medicine, and a semi-solid oil is extracted from the seed.

		lbs.
D 3209.	Cuddapah, Madras (Higgens)	—
D 3940.	Nellore, Madras (Brougham)	62
D 4331.	Kondavid Forest, Kistna (Gamble)	72 (wet)

B 2259 (51 lbs.) is a white moderately-hard wood sent by Col. Ford from the Andamans in 1866; it perhaps belongs to this species.

2. **S. detergens,** Roxb. Fl. Ind. ii. 280; Brandis For. Fl. 107. *S. Mukorossi*, Gaertn.; Fl. Br. Ind. i. 96. The Soapnut of N. India. Vern. *Ritha, dodan, kanmar*, Hind.

A handsome deciduous tree. *Bark* grey. *Wood* light yellow, rough, moderately hard, compact and close-grained. *Annual rings* distinctly marked by a band of pale tissue with large pores; the *pores* in the rest of the wood very small, surrounded by and united by patches more or less concentric of pale tissue. *Medullary rays* not straight, short, fine, numerous.

Apparently wild in the valleys of the West Himalaya at about 2–4000 ft.; elsewhere and largely cultivated about villages, in avenues, etc.

The fruit is used for the same purposes as that of *S. emarginatus*. The wood is not used; it weighs about 44 lbs. per cubic foot. The leaves are cut for fodder and the seeds used in native medicine.

		lbs.
H 117.	Waziri Rupi, Kulu, 4000 ft.	44
H 3050.	Kepu, Sutlej Valley, 2000 ft. (Gamble)	—
	Nordlinger's Sections, vol. 10 (Tab. IV. 5).	

3. **S. attenuatus,** Wall.; Fl. Br. Ind. i. 684; Gamble Darj. List 22. *Sapindus ruber*, Kurz For. Fl. i. 298. *Scytalia rubra*, Roxb. Fl. Ind. ii. 272. Vern. *Achatta*, Nep.; *Sirhootúngchir*, Lepcha; *Lal koi-pura*, Sylhet.

A shrub or small tree. *Bark* thin, grey. *Wood* white, moderately hard. *Annual rings* marked by darker lines. *Pores* moderately large, scanty, often in short radial or wavy lines. *Medullary rays* short, white, very fine, numerous.

Eastern Himalaya, Assam and Eastern Bengal, down to Chittagong.

Flowers red. Fruit eaten in Sylhet.

E 3272. Western Dúars (Gamble).

4. **S. Danura,** Voigt; Fl. Br. Ind. i. 684; Kurz For. Fl. i. 298. *Scytalia Danura*, Roxb. Fl. Ind. ii. 274. *S. verticillata*, Roxb. Fl. Ind. ii. 273. *Aphania Danura*, Radlk.; King in Journ. As. Soc. Beng. lxv. ii. 712. Vern. *Nancha, danúra*, Beng.

A small tree. *Wood* white, moderately hard. *Pores* moderate-sized, scanty, surrounded by and joined by more or less concentric patches of pale tissue, alternating with darker bands of harder substance without pores. *Medullary rays* very fine, numerous.

Northern and Eastern Bengal, Burma, the Andamans and Nicobar Islands, often in tidal forests. Sometimes cultivated as a garden shrub.

E 3373. Kaptai, Chittagong Hill Tracts (Gamble).

14. XEROSPERMUM, Blume. *X. Noronhianum*, Bl.; Fl. Br. Ind. i. 686; Kurz For. Fl. i. 295, is an evergreen tree of Sylhet, the Khasia Hills and Tenasserim.

15. NEPHELIUM, Linn. (with *Euphoria*).

About seven species, but the synonymy seems confused, and it is difficult to reconcile the accounts given in the Fl. Br. Ind. and those of Kurz and King. Except those described below, none are, however, of much consequence. *N. Gardneri*, Thw.; Trimen Fl. Ceyl. i. 309; Vern. *Nurai*, Tam., is a rare tree of Ceylon. *N. hypoleucum*, Kurz For. Fl. i. 293; Vern. *Kyetmauk*, Burm., is an evergreen tree of tropical forests in Burma. *N. Griffithianum*, Kurz For. Fl. i. 294, is an evergreen tree of the Upper Burma Hills. The "*Ramboetan*" fruit is the produce of *N. lappaceum*, Linn., which Beddome says has been introduced into gardens in India and Ceylon, but I have never seen it. It is a beautiful red fruit with echinate rind, and, with the similar "*Poelassan*" (*N. mutabile*, Br.), is largely grown in Java and much appreciated. They may both be seen for sale in the Javanese bazars and in baskets at the railway stations.

Wood red, hard; prominent wavy concentric bands.

1. **N. Longana,** Camb.; Fl. Br. Ind. i. 688; Kurz For. Fl. i. 294; Talbot Bomb. List 59; Trimen Fl. Ceyl. i. 309. *Euphoria Longana*, Lamk.; Bedd. Fl. Sylv. t. 156. *Scytalia Longana*, Roxb. Fl. Ind. ii. 270. The Longan. Vern. *Ashphal*, Beng.; *Poovati, katta puvan, nurai*, Tam.; *Puni*, Courtallum; *Wumb*, Mar.; *Mal ahoótá, kanakindali*, Kan.; *Shempúvan, mulei*, Trav. Hills; *Kyetmauk*, Burm.; *Mora, rasa-mora*, Cingh.

A large evergreen tree. *Bark* smooth, yellowish-grey. *Wood* red, moderately hard. *Pores* small, numerous, uniformly distributed;

the transverse diameter equal to the distance between the fine and very fine *medullary rays*. Prominent, wavy bands, broader than the rays, divide the wood into a succession of concentric strata.

Common in all the forests of the Western Ghâts, in the Konkan, Kanara, Malabar, the Anamalai, Travancore and Tinnevelly Hills up to 3000 ft.; scarce in Burma, only in tropical forests of the eastern slopes of the Pegu Yoma; common in Ceylon.

A handsome tree, young leaves red. The wood is hard and durable, but little used. Kurz says it is good for furniture and takes a fine polish. Wallich, No. 179, gives W = 44 lbs.; A. Mendis 62 lbs.; Bourdillon gives W = 61 lbs., P = 1061; O'Connell gives W = 61 lbs.; our specimens have an average of 59 lbs. The fruit, the "Longan," is eaten, but is much inferior to the Litchi, Ramboetan and Poelassan. Mendis calls it "Eyeball tree."

The leaves of the Longan suffer greatly from damage done by a Limacodid moth, *Parasa lepida*, Cram., which eats the leaves, sometimes completely defoliating the tree.

	lbs.
D 1278. Anamalai Hills, Coimbatore (Beddome)	51
W 4539, 4668. Travancore (Beddome)	59 and 65
No. 57, Ceylon Collection, old; No. 95, new (A. Mendis). . .	62
Nordlinger's Sections, vol. 9.	

2. N. Litchi, Camb.; Fl. Br. Ind. i. 687; Kurz For. Fl. i. 283; Talbot Bomb. List 59. *Scytalia Litchi*, Roxb. Fl. Ind. ii. 269. The Litchi. Vern. *Litchi*, Hind. (originally Chinese); *Kyetmauk*, Burm.

A handsome evergreen tree. *Bark* thin, grey, rough. *Wood* red, hard, heavy. *Pores* moderate-sized, the transverse diameter usually considerably greater than the distance between the rays. *Medullary rays* very fine, very numerous. Wavy bands not so prominent as in *N. Longana*.

Introduced from South China, and now cultivated largely in Northern India for its delicious fruit. It thrives admirably all over Bengal and northwards to Saharanpur and Dehra Dún. It is common in Chittagong, and has been planted in Bombay and Madras, but I never saw any good fruit produced at the latter place.

	lbs.
O 3260. Saharanpur Bot. Garden (Duthie)	—
O 4762. Forest School Garden, Dehra Dún (Gamble)	68
D 3973. Agri-Hortl. Garden, Madras (Steavenson)	56
Nordlinger's Sections, vol. 5.	

3. N. stipulaceum, Bedd. Fl. Sylv. t. 155; Fl. Br. Ind. i. 690. Vern. *Kánam mayili*, Trav. Hills.

A handsome tree. *Wood* red, very hard. *Pores* moderate-sized, scanty, filled with light-coloured matter. *Medullary rays* very fine, very numerous. Concentric bands of darker colour frequent.

Hills of S. India from the Nilgiris southwards, on the western slopes, up to 3000 ft.

	lbs.
W 4688. Travancore (Bourdillon)	64

16. POMETIA, Forst.

1. P. tomentosa, Bth. and Hook. f.; Fl. Br. Ind. i. 691; Kurz For. Fl. i. 295. *Pometia eximia*, Bedd. Fl. Sylv. t. 157; Trimen Fl. Ceyl. i. 310. Vern. *Thabyay*, Burm.; *Badoh*, And.; *Galmora, bulumora*, Cingh.

A very large tree. *Wood* red. *Pores* large, scanty, uniformly distributed, prominent on a vertical section. *Medullary rays* very fine, closely packed. Prominent concentric lines of darker colour.

Moist low country of Ceylon; Andaman Islands, very common.

The specimen does not agree very well with Kurz's description of the wood as "whitish, very light and very coarsely fibrous." It agrees better with Trimen's.

B 1973.	Andaman Islands (Kurz, 1866)	lbs. 48

17. HARPULLIA, Roxb.

1. **H. cupanioides,** Roxb.; Fl. Br. Ind. i. 692; Kurz For. Fl. i. 287; Talbot Bomb. List 59. *H. imbricata,* Bl.; Bedd. Fl. Sylv. t. 158; Trimen Fl. Ceyl. i. 311. Vern. *Harpulli,* Beng.; *Chittila madaku,* Trav. Hills; *Na-imbul, pundalu,* Cingh.

A large tree. *Bark* smooth, pale. *Wood* white, soft. *Pores* moderate-sized, scanty, in whitish patches. *Medullary rays* fine, numerous.

Forests of Chittagong; the Andaman Islands; the western coast from the Konkan southwards; moist low country of Ceylon.

A handsome tree with a brilliant orange-coloured fruit, which is used in Ceylon for washing.

W 4717.	Travancore (Bourdillon).	lbs. 40

18. ZOLLINGERIA, Kurz. *L. macrocarpa,* Kurz For. Fl. i. 288; Fl. Br. Ind. i. 692; Vern. *Wetkyut,* Burm., is a large tree of the mixed dry forests of the Prome District with a white wood.

Tribe II. ACERINEÆ.

19. ACER, Tournef.

About 16 species, all Himalayan or from the hills of Upper Assam, three species only extending to the hill forests of Burma. *A. niveum,* Bl.; Fl. Br. Ind. i. 693; Kurz For. Fl. i. 289, is a tree of the hills of Upper Assam and of the ranges east of the Sittang River at 4–6000 ft. *A. isolobum,* Kurz For. Fl. i. 289; Fl. Br. Ind. i. 694, is an evergreen tree of the damp hill forests of Martaban at 5–7000 ft. *A. stachyophyllum,* Hiern in Fl. Br. Ind. i. 694, is a small tree of the Sikkim and Bhutan Himalaya at 9–10,000 ft. *A. pectinatum,* Wall. (*A. caudatum,* Wall.; Fl. Br. Ind. i. 695 (part); Gamble Darj. List 22); Vern. *Kabashi,* Nep.; *Yalishin,* Bhutia; and *A. Papilio,* King in Journ. As. Soc. Beng. lxv. ii. 10, are small trees of the inner Sikkim Himalaya at 8–12,000 ft., the former common on the Singalila Range.

The common European Maple is *A. campestre,* Linn.; the Sycamore is *A. pseudoplatanus,* Linn.; the Norway Maple is *A. platanoides,* Linn., and the Sugar Maple of America is *A. saccharinum,* Wang.

Wood generally shining, soft and close-grained; no heartwood. *Annual rings* generally well marked. *Pores* small and very small, uniformly distributed. *Medullary rays* fine and very fine, often of two sizes. Concentric medullary patches frequent. (The structure of the wood of the different species of Maple, European, Indian and American, is so uniform that it is very difficult, if not impossible, to distinguish the different species by it alone.)

1. **A. oblongum,** Wall.; Fl. Br. Ind. i. 693; Brandis For. Fl. 110; Gamble Darj. List 22. Vern. *Mark,* Pb.; *Pharengala, patangalia, kirmoli,* N.-W. P.; *Pangoi, paranga,* Jaunsar; *Parpat, galiya, potai, putli,* Kumaon; *Kirmola,* Garhwal; *Pangyála,* Dotiál; *Mugila, buzimpala,* Nep.

A moderate-sized deciduous tree. *Bark* dark grey, smooth, with horizontal wrinkles. *Wood* light reddish-brown, moderately hard, close-grained. *Annual rings* faintly marked. *Pores* small, uniformly distributed. *Medullary rays* fine, red, distinctly visible on a radial section, giving the wood an elegant silver-grain.

Himalaya from the Jhelum eastwards to Bhutan, up to 6000 ft. A low-level species descending even to the Dehra Dún at 2000 ft., and most common in valleys of the outer hills.

Growth moderate, 7 rings per inch of radius. The wood is used for agricultural implements and drinking-cups.

		lbs.
H 221.	Garhwal (1868)	45
H 2944.	Sutlej Valley, near Suni, 3000 ft. (Gamble)	—

2. A. lævigatum, Wall.; Fl. Br. Ind. i. 693; Brandis For. Fl. 110; Kurz For. Fl. i. 289; Gamble Darj. List 22. Vern. *Saslendi, cherauni, thali kabashi,* Nep.; *Tungnyok,* Lepcha.

A large deciduous tree. *Bark* thick, smooth, grey. *Wood* white, shining, hard, close-grained. *Pores* small, scanty, often subdivided. *Medullary rays* short, not straight, fine and moderately broad, prominent, dark.

Himalaya from the Jumna eastwards to Bhutan, at 5–9000 ft.; Khasia Hills; hills of Upper Tenasserim, and those of the Ruby Mines District in Burma.

The wood is used for planking and tea-boxes.

		lbs.
E 684.	Sepoydura, Darjeeling, 5500 ft. (Johnston)	43
	Nordlinger's Sections, vol. 9.	

3. A. sikkimense, Miq.; Fl. Br. Ind. i. 694; Gamble Darj. List 22. Vern. *Palegnyok,* Lepcha.

A small tree. *Bark* thin, grey. *Wood* shining, grey, annual rings distinct. *Pores* small, very numerous. *Medullary rays* fine, numerous.

Hills of Sikkim and Bhutan, at 7–9000 ft.; Mishmi Hills.

Growth slow, 10 to 15 rings per inch of radius. It sometimes is found apparently epiphytic from the seeds having germinated among débris in the branches of other trees.

		lbs.
E 3102.	Darjeeling, 7000 ft. (Gamble)	37

4. A. Hookeri, Miq.; Fl. Br. Ind. i. 694; Gamble Darj. List 22. Vern. *Lal kabashi,* Nep.; *Palé,* Lepcha.

A deciduous tree. *Bark* brown, ¼ in. thick, deeply cracked. *Wood* grey. *Pores* small. *Medullary rays* fine, red, very numerous.

Sikkim and Bhutan, above 7000 ft.

Growth moderate, 8 rings per inch of radius. Plants with copper-coloured foliage are not uncommon about Darjeeling.

		lbs.
E 2338.	Rangbúl, Darjeeling, 7500 ft. (Gamble)	37

5. A. pentapomicum, J. L. Stewart, ex Brandis For. Fl. 111; Fl. Br. Ind. i. 694. Vern. *Trekan, kukandra, kakkri, kitla, kunghi, tián, serán, tilpatto, kilpattar,* Pb.

A small tree. *Bark* grey, thin, very prettily tessellated by shallow vertical clefts, joined more or less ladder-like but irregularly by horizontal ones. *Wood* pinkish-white, soft, close- and even-grained. *Annual rings* marked by dark lines, but with many false rings. *Pores* small, uniformly distributed. *Medullary rays* fine, not very numerous, causing a marked and elegant silver-grain.

Punjab Himalaya, from the Jhelum to the Sutlej at 2–7000 ft., in exposed hot dry places in valleys.

This is only a small tree: Brandis says that the largest trunk noted by Stewart had 5½ ft. in girth, but was much above the average. Mr. Elliott's specime n

about 17 in. in girth for nearly 50 years of age. The wood is used for ordinary domestic and agricultural purposes.

		lbs.
H 4843.	Chamba, Punjab (Elliott)	36

6. **A. cæsium**, Wall.; Fl. Br. Ind. i. 695; Brandis For. Fl. 111. Vern. *Trekhan, tarkhana, tilpattar, mandar, kauri, kalindra, salíma, kanzal, bodal*, Pb.; *Kanar*, Kashmir; *Kanshin*, Tibet; *Jerimu, shumanjra*, Simla; *Kilu*, Kumaon; *Kainju*, Jaunsar.

A large deciduous tree. *Bark* grey, exfoliating in long vertical strips. *Wood* white, close-grained, soft to moderately hard. *Annual rings* distinct. *Pores* small, fairly numerous, uniform, between the fine, very numerous dark *medullary rays*, which give a pretty silver-grain.

West Himalaya from the Indus to Nepal, at 7–11,000 ft.

Growth slow, 9 to 31 rings per inch of radius, giving an average of 18. Weight 40 lbs. per cubic foot. The wood is scarcely used; drinking-cups are sometimes made of it by the Tibetans.

		lbs.
H 33.	Matiyána, Simla, 7000 ft.	40
H 915.	Hazara, Punjab, 7000 „	41
H 3009, 2901.	Nagkanda, Simla, 9000 ft. (Gamble)	—
H 431.	Deoban, Jaunsar, 8000 ft. (Bagshawe)	40
	Nordlinger's Sections, vol. 8 (Tab. V. 2).	

7. **A. Thomsoni**, Miq.; Gamble Darj. List 22. *A. villosum*, Wall. var.; Fl. Br. Ind. i. 695. Vern. *Kabashi*, Nep.

A large tree. *Bark* thin, grey. *Wood* greyish-white, soft. *Pores* small. *Medullary rays* fine and moderately broad, numerous.

Hills of Sikkim and Bhutan above 4000 ft.

Growth slow, 16 rings per inch of radius.

		lbs.
E 3103.	Darjeeling, 5000 ft. (Gamble)	44

8. **A. villosum**, Wall.; Fl. Br. Ind. i. 695; Brandis For. Fl. 111. Vern. *Karendera*, Simla; *Kainju*, Jaunsar.

A large deciduous tree. *Bark* thin, grey. *Wood* white, moderately hard, close-grained, beautifully mottled and shining. *Annual rings* distinct. *Pores* scanty, small, uniform, uniformly distributed. *Medullary rays* short, fine and moderately broad, making a pretty silver-grain.

West Himalaya from the Jhelum to Nepal at 7–9000 ft.

Growth slow, 16 rings per inch of radius. The wood is not used. The large leaves are lopped for fodder.

		lbs.
H 62.	Nagkanda, Simla, 8000 ft.	38
H 3006. / H 2899.	„ „ „ (Gamble)	—
H 167.	Kangra (1866)	—
	Nordlinger's Sections, vol. 8.	

9. **A. caudatum**, Wall.; Fl. Br. Ind. i. 695; Brandis For. Fl. 112. Vern. *Kanzlo, kandaru, kanjara*, Simla; *Kainjli, kanjla*, Jaunsar; *Khansing, kabashi*, Nep.; *Yalishin*, Bhutia.

A moderate-sized deciduous tree. *Bark* dark grey. *Wood* white, with a faint pink tinge, shiny, compact, moderately hard, sometimes with small masses of heartwood near the centre. *Annual rings* distinct. *Pores* small, rather scanty, uniform and uniformly distributed. *Medullary rays* moderately broad, short, giving a good silver-grain.

Himalaya, from the Chenab to Nepal at 7-11,000 ft.
Growth slow, 26 rings per inch of radius. Weight 43 lbs. per cubic foot.

		lbs.
H	27. Matiyána, Simla, 7000 ft.	45
H	41. Mahasu, „ 8000 „	44
H	74. Kalashi, „ 6000 „	41
H	3007. Nagkanda, „ 9000 „ (Gamble)	—

Nordlinger's Sections, vol. 8.

10. **A. Campbellii,** Hook f. and Th.; Fl. Br. Ind. i. 696; Gamble Darj. List 23. Vern. *Kabashi*, Nep.; *Daom, dóm, yali, yatli*, Lepcha.

A large deciduous tree. *Bark*, smooth, grey. *Wood* greyish-white, moderately hard, shining, close-grained. *Annual rings* marked by a thin line. *Pores* small, scanty, uniformly distributed, often subdivided. *Medullary rays* numerous, fine and moderately broad, short, dark, showing a pretty silver-grain and a satiny lustre.

Sikkim Himalaya, above 7000 ft.

The chief Maple of the East Himalaya, often reaching a height of 100 to 120 feet. It reproduces freely either by seed or by coppice, and plays an important part in the regeneration of the hill forests. The wood is extensively used for planking and for tea-boxes.

Growth moderate, 8 to 15 rings per inch of radius, but rather faster when young.

		lbs.
E	436. Rangbúl, Darjeeling, 7000 ft. (Johnston)	37
E	2337. „ „ „ (Gamble)	40
E	686. Sepoydura, Darjeeling, 5500 ft. (Manson)	37

Nordlinger's Sections, vol. 8 (Tab. V. 1).

12. **A. cultratum,** Wall. *A. pictum*, Thunb.; Fl. Br. Ind. i. 696; Brandis For. Fl. 112. Vern. *Kilpattar, trekhan, tarkhana, kakru, kanzal, kanjar, jerimu, laur, tian*, Pb.; *Kancheli, kainjli*, N.-W. P.; *Kainchli, kabási*, Jaunsar; *Dhadonjra*, Simla; *Tikta, pata, bankipnu*, Kumaon; *Gadkimu, potli, dumitha*, Garhwal; *Chindia, tiláni, chitulia*, Dotial.

A moderate-sized tree. *Bark* thin, grey. *Wood* white, soft to moderately hard, close-grained. *Pores* very small, scanty. *Medullary rays* fine and very fine, dark, with a pretty, fine silver-grain.

Outer and Middle Himalaya from the Indus to Assam, at 4-9000 ft.

The commonest Maple of the West Himalaya. The wood is used for construction, ploughs, bedsteads, and poles to carry loads. Tibetan drinking-cups are made of the knotty excrescences. The branches are lopped for fodder.

Growth moderate, 12 rings per inch of radius. Weight 41 lbs. per cubic foot.

		lbs.
H	931. Hazara, Punjab, 8000 ft. (Baden-Powell)	41
H	3008. Nagkanda, Simla, 9000 ft. (Gamble)	43
H	432. Deoban, Jaunsar, 7000 ft. (Johnston)	38

Nordlinger's Sections, vol. 8.

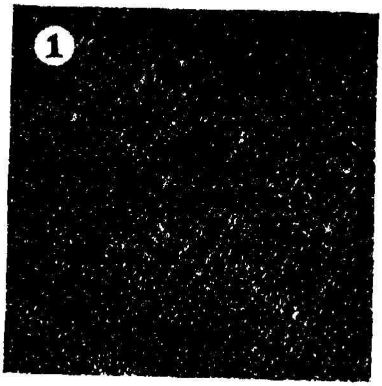
20. DOBINEA, Hamilt. *D. vulgaris*, Ham.; Fl. Br. Ind. i. 696; Gamble Darj. List 23; Vern. *Samli*, Nep., is a shrub of the Central and Eastern Himalaya, not uncommon in the Darjeeling Hills at 4-6000 ft.

TRIBE III. DODONÆEÆ.

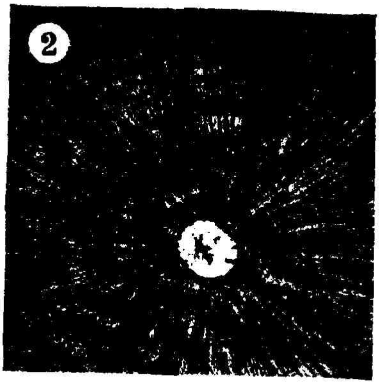
21. DODONÆA, Linn.

1. **D. viscosa,** Linn.; Fl. Br. Ind. i. 697; Bedd. Fl. Sylv. lxxv.; Brandis For. Fl. 113; Kurz For. Fl. i. 287; Gamble Darj. List 23; Talbot Bomb. List 60; Trimen Fl. Ceyl. i. 312. *D. dioica*, Roxb. and *D. angustifolia*, Linn. f.; Roxb. Fl. Ind. ii. 256. Vern. *Sanatta, mendru, ban mendu*, Pb.; *Banderu*, C.P.; *Bandurai, bandrike*.

V.

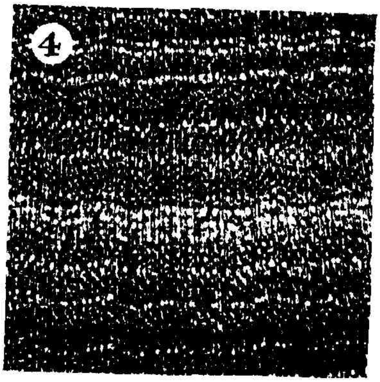


ACER CAMPBELLII.

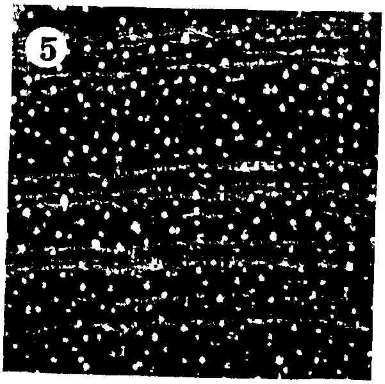


ACER CÆSIUM.

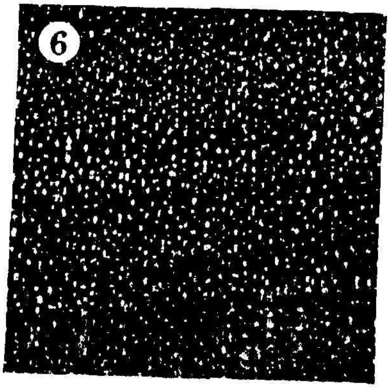
MELIOSMA DILLENIÆFOLIA.



PISTACIA INTEGERRIMA.



MELANORRHŒA USITATA.



ODINA WODIER.

(Magnified 3½ times.)

Kan.; *Lutchmi, paorki*, Mar.; *Baru*, Melghát; *Vullari, bhandaru*, Badaga; *Virdli*, Mal.; *Eta-werella*, Cingh.

An evergreen shrub. *Bark* thin, grey, exfoliating in long thin strips. *Wood* extremely hard and close-grained, dark brown, with an irregular outline, sometimes mottled with black, sapwood pale. *Annual rings* (?) marked by fine white lines. *Pores* very small, scattered or in short radial lines. *Medullary rays* fine, very numerous, the distance between them equal to the diameter of the pores.

West Himalaya from the plains up to 4500 ft.; Punjab, Sind, Baluchistan; South India, in the Deccan and Carnatic as a shrub, in the hills ascending to 8000 ft. and attaining, in suitable places on the Nilgiris and elsewhere, the size of a small tree; Burma, on the sandy shores from Amherst to Mergui; Great Coco Island and Narcondam; planted throughout India as a hedge plant.

Growth slow, 11 to 12 rings per inch of radius. The wood is used for engraving, turning, tool-handles and walking-sticks, and the branches to support the earth of flat roofs. It is very heavy, 75 to 78 lbs. per cubic foot, and often very prettily marked. The shrub is likely to be important in reclothing denuded tracts like the Siwalik Hills of Hoshiarpur, and the ravines of the outer Himalaya. It is often gregarious.

		lbs.
P 894.	Salt Range, Punjab (Baden-Powell)	—
D 3967.	Cuddapah Forests (Gamble)	—
W 3730.	Coonoor, Nilgiris, 6000 ft. (Gamble)	75
W 3877.	Ootacamund, Nilgiris, 7500 ft. (Gamble)	78

TRIBE IV. STAPHYLEÆ.

22. STAPHYLEA, Linn.

1. **S. Emodi**, Wall.; Fl. Br. Ind. i. 698; Brandis For. Fl. 114. Vern. *Marchob* (Serpent Stick), Afg.; *Naydaun, chitra, chúal, ban-bakhru, banshayali, gúldar, kághania*, Hind.

A large shrub or small tree. *Bark* grey, with darker longitudinal, anastomozing streaks. *Wood* moderately hard, greyish-white. *Pith* large. *Pores* very small, evenly distributed. *Medullary rays* fine to moderately broad, short, rather scanty.

West Himalaya above 6000 ft. from the Indus to the Sarda; nowhere very common, but found fairly evenly distributed in ravines and moist forests of fir and oak and mixed trees.

Sticks are made of the wood, which are sold in the hill bazars. They are supposed by the Afghans and frontier tribes to have the property of keeping off snakes. Weight 43 lbs. per cubic foot.

		lbs.
H 3189.	Dungagalli, Hazara, 7000 ft. (Wild)	47
H 2900.	Nagkanda, Simla, 8000 ft. (Gamble)	41
H 4419.	Lambatách Forest, Tehri-Garhwal, 7000 ft. (Gamble)	44

23. TURPINIA, Vent.

Contains two Indian species, which in the "Flora of British India" are described as one. *T. pomifera*, DC; Kurz For. Fl. i. 292; Gamble Darj. List 23; Talbot Bomb. List 60; Trimen Fl. Ceyl. i. 313; Vern. *Nagpat*, Nep.; *Singnok*, Lepcha; *Bandibru*, Mechi, is a tree of the tropical forests of Bengal, W. and S. India, Burma and Ceylon; while *T. nepalensis* comes from the hills. As seen growing, they look perfectly distinct, as I fully believe them to be, in agreement with Kurz.

1. **T. nepalensis**, Wall.; Bedd. Fl. Sylv. t. 159; Kurz For. Fl. i. 292; Gamble Darj. List 23. *T. pomifera*, DC; Fl. Br. Ind. i. 698 (part). Vern. *Thali*, Nep.; *Murgut*, Lepcha; *Nila*, Badaga; *Taukshama, daukyama*, Burm.; *Pambavetti, santha*, Trav. Hills.

A moderate-sized deciduous tree. *Bark* $\frac{1}{10}$ in. thick, grey, rough with corky protuberances or smooth. *Wood* grey, soft, even-grained. *Pores* small, very numerous, uniformly distributed. *Medullary rays* of two classes, the first being moderately broad, scanty, short, and the second fine, very numerous.

Himalaya from Nepal eastwards, between 4000 and 7000 ft.; Assam, Cachar, Chittagong and Burma, in hill forests; hills of S. India and Ceylon at high levels.

Weight 30 to 35 lbs. per cubic foot. Wood not used, leaves given as fodder to cattle.

		lbs.
E 649.	Sepoydura Forest, Darjeeling, 5500 ft. (Manson)	30
E 3108.	Darjeeling, 6000 ft. (Gamble)	—
W 3734.	Coonoor, Nilgiris, 6000 ft. (Gamble)	—
W 3917.	Aramby Reserve, Ootacamund, 7000 ft. (Gamble)	35

W 4594 from Travancore (Bourdillon), 28 lbs., is *T. pomifera*, but unfortunately no note of structure has been kept. It was, however, like the wood of *T. nepalensis*. Bourdillon gives W = 27 lbs. and P = 388, and says the wood is useless.

ORDER XXXVII. SABIACEÆ.

An Order of but small importance; containing, however, several handsome trees, chiefly of the hilly regions.

Two genera, Sabia and Meliosma, the former of climbing shrubs, the latter of trees.

1. SABIA, Colebr.

About ten climbing or sarmentose shrubs, often with blue drupes, usually in pairs. *S. leptandra*, Hook. f. and Th.; Fl. Br. Ind. ii. 2; Gamble Darj. List 23; Vern. *Simali*, Nep.; *Pryongrik*, Lepcha; is a climber of the Sikkim Himalaya. *S. parviflora*, Wall. and *S. limoniacea*, Wall. also occur in the Central and Eastern Himalaya, and *S. malabarica*, Bedd. in the hills of S. India, especially the Anamalais. The rest are found chiefly in Assam.

1. S. campanulata, Wall.; Fl. Br. Ind. ii. 1; Brandis For. Fl. 116. Vern. *Bakulpata*, Kumaon.

A small climbing shrub. *Wood* soft, porous, brown. *Pores* large, scattered. *Medullary rays* broad.

Western and Central Himalaya from Simla to Sikkim above 5000 ft., in undergrowth of fir and oak forests. Drupes turquoise-blue.

H 3030. Nagkanda Forest, Simla, 9000 ft. (Gamble).
H 3193. Theog, Simla, 7000 ft. (Gamble).

2. S. paniculata, Edgew.; Fl. Br. Ind. ii. 3; Brandis For. Fl. 117; Gamble Darj. List 23.

A large extensively-climbing shrub. *Bark* dark brown, thick, warted with prominent lenticels. *Wood* soft, porous. *Pores* large, uniformly distributed in the wedges of tissue between the very broad *medullary rays*.

Sub-Himalayan tract from the Jumna to Sikkim up to 3000 ft., in swampy forests.
O 4834 (*bis*). Dehra Dún, 2300 ft. (Babu U. N. Kanjilal).

2. MELIOSMA, Blume.

Ten species: five with simple and five with pinnate leaves. Two are found in the West Himalaya four in the East Himalaya and E. Bengal, three in S. India and

Ceylon, and three in Burma. *M. pinnata*, Hook. f.; Gamble Darj. List 24 (*Millingtonia pinnata*, Roxb. Fl. Ind. i. 104); Vern. *Bolay*, Nep.; *Batiwa*, Sylhet, is a tree of the East Himalaya, Assam, the Khasia Hills and Sylhet, up to 3000 ft. *M. Collettiana*, King in Journ. As. Soc. Beng. lxv. ii. 11, is a tree found recently at Maymyo, Ruby Mines District, Upper Burma.

Wood soft to moderately hard, white or brown. *Pores* small, scanty, in groups or short radial lines. *Medullary rays* moderately broad to broad, the silver-grain conspicuous.

1. **M. dilleniæfolia**, Bl.; Fl. Br. Ind. ii. 4; Brandis For. Fl. 115; Gamble Darj. List 23. Vern. *Bakraina, bakrasang, shapra*, Sutlej; *Porda, parenga, philli*, Simla; *Gwep*, N.-W. P.; *Goi*, Jaunsar; *Moya*, Garhwal; *Patmoya*, Dotiál; *Siamunú*, Nep.

A small deciduous tree. *Bark* dark grey. *Wood* white, moderately hard, even-grained. *Annual rings* marked by a continuous line of pores, and darker colour. *Pores* small, single or subdivided or in rounded groups, except along the annual rings. *Medullary rays* wavy, moderately broad and fine, distinctly marked in a silver-grain, which has a satiny lustre.

Throughout the Himalaya, at 4–11,000 ft., from the Sutlej to Bhutan, in shady ravines in the forests of fir or oak or mixed trees.

Growth moderate, 4 to 6 rings per inch of radius.

		lbs.
H 60.	Nagkanda, Simla, 8000 ft.	38
H 2892.	" " " (Gamble)	35
H 4769.	Deota, Tehri-Garhwal, 8009 ft. (Gamble)	38
	Nordlinger's Sections, vol. 8 (Tab. V. 3).	

2. **M. pungens**, Wall.; Fl. Br. Ind. ii. 4; Brandis For. Fl. 116. Vern. *Gardar, Kharás*, Kumaon; *Bushkua*, Jaunsar; *Kharás*, Garhwal.

A moderate-sized or small tree. *Bark* reddish-brown, 1/6 in. thick, longitudinally wrinkled. *Wood* soft to moderately hard, light reddish-brown. *Pores* small, in groups or radial lines of 2 to 8. *Medullary rays* moderately broad to broad, making a conspicuous silver-grain.

West Himalaya from the Sutlej to Nepal at 2–5000 ft., usually in valleys and along streams.

H 4910. Upper Tons Valley, Tehri-Garhwal (B. B. Osmaston).

3. **M. ferruginea**, Kurz; King in Journ. As. Soc. Beng. lxv. ii. 11. Vern. *Sinduri dabdabbi*, Nep.

A large tree. *Bark* ½ in. thick, greyish-brown, smooth. *Wood* brown, soft. *Pores* moderate-sized, scanty, single or in radial lines of several. *Medullary rays* moderately broad to broad, giving a conspicuous silver-grain.

Sikkim Himalaya at 2–6000 ft.

		lbs.
E 4866.	Tukdah, Darjeeling, 5000 ft. (C. G. Rogers)	30

4. **M. Wightii**, Planch.; Fl. Br. Ind. ii. 4; Brandis For. Fl. 116; Talbot Bomb. List 60; Trimen Fl. Ceyl. i. 314. *M. pungens*, Bedd. Fl. Sylv. lxxvii. Vern. *Tode*, Badaga.

A large tree. *Bark* ½ in. thick, brown, smooth. *Wood* dark reddish-brown, soft. *Pores* moderate-sized, often subdivided, scanty. *Medullary rays* moderately broad, numerous, giving a pretty silver-grain.

Hills of Western and Southern India, from the Konkan southwards, common in Nilgiri sholas at and above 5000 ft.

A fine tree. Beddome says it is called "Hill Mango" by Europeans on the Nilgiris, from its likeness to a Mango tree when in flower. The wood is poor, and not used even for fuel.

		lbs.
W 3882.	Aramby Forest, Ootacamund, 7000 ft. (Gamble)	41
W 4182.	Lovedale, Ootacamund, 7000 ft. (Gamble)	31

5. **M. simplicifolia,** Hook. f.; Fl. Br. Ind. ii. 5; Bedd. Fl. Sylv. lxxvii.; Brandis For. Fl. 116; Kurz For. Fl. i. 301; Gamble Darj. List 23; Trimen Fl. Ceyl. i. 315. *Millingtonia simplicifolia,* Roxb. Fl. Ind. i. 103. Vern. *Kosrú*, Nep.; *Hingman*, Lepcha; *Koko,* Mechi; *Dibru*, Ass.; *Dantrungi*, Sylhet; *Rong*, Chittagong; *Gokpak*, Magh; *Elbedda*, Cingh.

An evergreen tree. *Wood* reddish, moderately hard, warps. *Pores* small and moderate-sized, single or in short radial lines, numerous, uniformly distributed. *Medullary rays* moderately broad, very numerous; silver-grain pretty and conspicuous.

Eastern Himalaya, Assam, Chittagong, Burma, South India and Ceylon, in ravines and shady places in the forests, at 2–3000 ft.

Weight: Bourdillon gives W = 31 lbs., P = 370; the specimens give an average weight of 33 lbs.

		lbs.
E 2339.	Sivoke, Darjeeling Terai (Gamble)	36
W 4635.	Travancore (Bourdillon)	30

6. **M. Wallichii,** Planch.; Fl. Br. Ind. ii. 6; Gamble Darj. List 24. Vern. *Dabdabbi*, *nunewalai*, Nep.; *Himan*, Lepcha.

A large deciduous tree. *Wood* white, very soft, spongy. *Pores* large, in scattered groups of five to ten. *Medullary rays* broad and fine, distinctly marked on a radial section in a conspicuous silver-grain.

Eastern Himalaya and Khasia Hills, above 5000 ft.; common about Darjeeling.

Growth moderate, 8 to 10 rings per inch of radius. The tree is, however, often fast grown, especially if from coppice shoots: one in the Park, Darjeeling, showed a girth of 22 in. and a height of 32 ft. at an age of 22 years, giving thus 6½ rings per inch of radius. Specimens showing still faster growth are not uncommon. Weight 18 lbs. per cubic foot. The wood is used only for firewood or very occasionally for boxes.

		lbs.
E 361.	Rangbúl, 7000 ft. (Johnston)	18
E 3672.	The Park, Darjeeling, 7000 ft. (Gamble)	—

7. **M. Arnottiana,** Walp.; Fl. Br. Ind. ii. 6; Bedd. Fl. Sylv. t. 160; Trimen Fl. Ceyl. i. 315. Vern. *Huli mukki*, Badaga; *Massivára*, Mysore; *Kusavi*, *kalavi*, Trav. Hills; *Nikadawulu*, Cingh.

A large tree. *Bark* brown, rather thick. *Wood* dark reddish-brown, soft, liable to warp. *Pores* moderate-sized, scanty. *Medullary rays* moderately broad, numerous, giving a marked silver-grain. Soft concentric lines regular, about 8 to the inch, doubtfully annual rings.

Hill tracts of South India at 4–7000 ft., very common and conspicuous in Nilgiri and Anamalai sholas, when in flower; similar regions in Ceylon.

Beddome says the Badaga name signifies "Tiger wood," and that the heartwood is striped red and white; this I have, however, never noticed. The wood is scarcely, if ever, used. Bourdillon gives W = 21 lbs., P = 325; the specimens average 25 lbs.

		lbs.
W 3905.	Coonoor, Nilgiris, 5000 ft. (Gamble)	30
W 4608.	Travancore (Bourdillon)	20

ORDER XXXVIII. ANACARDIACEÆ.

Contains 20 Indian genera of trees, rarely shrubs or climbers. Many of the species are very important forest trees, and they are dispersed over the whole of India, but most particularly in Madras and Burma. They have often an acrid juice capable of raising blisters, and several species give a varnish. The Order is divided into two Tribes, viz.—

Tribe I. Anacardieæ . . . Rhus, Pistacia, Mangifera, Anacardium, Bouea, Gluta, Buchanania, Melanorrhœa, Swintonia, Solenocarpus, Tapiria, Odina, Parishia, Semecarpus, Drimycarpus, Holigarna, Nothopegia, Campnosperma.

„ II. Spondieæ . . . Spondias, Dracontomelum.

Schinus molle, L., the "Pepper tree," is sometimes cultivated, especially on the Nilgiris.

The woods of the trees of this family are very variable as to colour, weight and hardness. *Pistacia*, some species of *Rhus*, *Gluta*, *Melanorrhœa*, *Odina*, *Nothopegia* and *Drimycarpus* have hard woods, red or yellow; those of *Semecarpus*, *Mangifera*, *Spondias*, *Holigarna*, *Buchanania* are more or less soft, and light grey or brown. In some the medullary rays are numerous, in others scanty, but the chief general character is that of large *pores*, scanty, prominent on a vertical section, and *medullary rays* soft, dark and inconspicuous. Concentric lines occur in some species, very numerous in *Nothopegia*, less so and much interrupted in *Melanorrhœa*, *Mangifera*, etc.

TRIBE I. ANACARDIEÆ.

1. RHUS, Linn.

About 12 species, chiefly Himalayan. Only one species extends to South India, and two to Burma. *R. paniculata*, Wall.; Fl. Br. Ind. ii. 10; Kurz For. Fl. i. 319; Vern. *Pyidin*, *kaunggale*, Burm., is a small deciduous tree of Bhutan, which also extends to upper Burma and the Shan Hills. The bark is used to adulterate cutch. *R. khasiana*, Hook. f.; Fl. Br. Ind. ii. 10; Kurz For. Fl. i. 320, is a large tree of the Khasia Hills and Chittagong. *R. Griffithii*, Hook. f., is a small tree of the Khasia Hills at 4–6000 ft. *Rhus Coriaria*, Linn., is the Sumach tree of Europe, whose leaves are used in tanning in the preparation of Morocco leather, and are probably among the best tans known, being at the head of those of the *pyrogallol* category. For high-class bookbinding Sumach-tanned leather is considered the best.

Wood grey, often streaked with a yellow or brown heartwood. *Pores* small, often large and in continuous porous belts in the spring wood. *Medullary rays* fine and moderately broad. In hardness the different species vary considerably.

1. R. Cotinus, Linn.; Fl. Br. Ind. ii. 9; Brandis For. Fl. 118. The Wig plant. *Sumac fustet*, Fr. Vern. *Paán*, *bhán*, *manu*, *banthra*, *túng*, *tugang*, *titri*, Pb.; *Túnga*, *túng*, *chaniát*, *ámi*, N.-W. P.; *Gadtúng*, Kumaon; *Jaltúnga*, Garhwal; *Chichri*, Dotiál.

A shrub or small tree, deciduous. *Bark* thin, reddish-brown, rough. *Wood* moderately hard; sapwood small, white; heartwood mottled, of a rich dark yellow colour, often streaked with brown or greenish-grey. *Annual rings* marked by a belt in the spring wood

of moderate-sized and large *pores*, the pores in the autumn wood very small, arranged in irregular, radial groups. *Medullary rays* fine, short.

Suliman Range, West Himalaya to Kumaon, ascending to 6000 ft. It is chiefly found in the underwood of forests of *Pinus longifolia*, and often more or less gregariously, but nowhere very common. Throughout South Europe.

Growth moderate; a specimen shows 7 rings per inch of radius (from Konain, Jaunsar). Weight: Mathieu gives 47 lbs., one specimen (not numbered) gives 51 lbs., No. 85 gives 56 lbs. per cubic foot. The wood is used in South Europe for inlaid and cabinet work. It has a beautiful colour, and when obtainable of sufficient size makes pretty carvings, picture-frames, etc. In the Himalaya the twigs are used for basket-making, and the bark and leaves for tanning.

		lbs.
H 85.	Bhajji, Simla, 6000 ft.	56
H 3182.	Dungagalli, Hazara (Wild)	—
	Nordlinger's Sections, vol. 1.	

2. **R. parviflora,** Roxb. Fl. Ind. ii. 100; Fl. Br. Ind. ii. 9; Brandis For. Fl. 119. Vern. *Túnga, rai túng, dungla, túmra, ranel*, Hind.; *Ninás*, Jaunsar.

A large shrub or small tree. *Bark* thin, rough, reddish-brown. *Wood* dark reddish-brown, streaked, very hard, close-grained; sapwood light brown. *Annual rings* marked by a line and rather more numerous pores. *Pores* small, scattered, sometimes in short radial strings. *Medullary rays* fine, numerous, the distance between them about equal to the diameter of the pores.

West Himalaya in hot dry valleys up to 4000 ft., from the Sutlej eastwards to Nepal; the Pachmarhi Hills, C.P.; the hills of the N. Circars and Godavari.

A gregarious shrub on bare dry slopes, as in the Tons Valley in Jaunsar. The fruit is eaten, and the leaves are dried and mixed with tobacco in Jaunsar.

		lbs.
H 4814.	Tiuni, Tons Valley, Jaunsar, 2500 ft. (Gamble)	61
C 3945.	Sukmamri Hill, Upper Godavari, 3000 ft. (Gamble)	—

3. **R. mysorensis,** Heyne; Fl. Br. Ind. ii. 9; Bedd. Fl. Sylv. lxxviii.; Brandis For. Fl. 119; Talbot Bomb. List 61. Vern. *Dasarni, dasan, davan, dasni*, Ajmere.

A small shrub. *Bark* thin, brown. *Wood* hard, reddish-yellow, close-grained, heavy. *Pores* moderate-sized, evenly distributed. *Medullary rays* fine, very numerous, wavy, bent where they touch the pores.

Suliman Range, from 2–5000 ft.; Sind, Punjab, Rajputana and the Deccan, gregarious in dry hot places. Common in Dharwar, Bellary and other parts of the S. Mahratta country, Ceded Districts and Mysore; often very spinous.

The wood is only used for fuel. The bark is used as a tan in Merwara (Duthie). The branches are used to fence fields.

P 3231. Nagpahar Forest, Ajmere.
P 3248. Ajmere.

4. **R. semialata,** Murray; Fl. Br. Ind. ii. 10; Brandis For. Fl. 119; Gamble Darj. List 24. *R. buckiamela*, Roxb. Fl. Ind. ii. 99. *R. javanica*, Linn.; Kurz For. Fl. i. 319. Vern. *Tatri, titri, chechar, arkhar, arkol, kakri, dúdla, kakkeran, wánsh, hulashing*, Pb.; *Rashtu, kashin*, Sutlej; *Dakhmila, dáswila*, N.-W. P.; *Tibri, arkhoi*, Jaunsar; *Dasmila, khunkia*, Garhwal; *Bhankachu*, Dotiál; *Bakkiamela, bhagmili*, Nep.; *Takhril*, Lepcha.

A moderate-sized deciduous tree. *Bark* ½ in. thick, rough, with deep vertical furrows. *Wood* soft, shining, grey with darker streaks. *Annual rings* marked by a broad belt of closely packed large pores, in the rest of the wood *pores* very small, in patches. *Medullary rays* fine, numerous.

Outer Himalaya from the Indus to Assam, ascending to 7000 ft.; Khasia Hills; Shan Hills plateau at 5000 ft. Often found in second-growth forests, *i.e.* in places where forest lands have been cultivated and then abandoned.

Growth variable: the Simla specimens had a slow growth of 16 rings per inch, while the Darjeeling specimen had grown very fast, 2 to 3 rings per inch of radius. Weight 26 to 27 lbs. per cubic foot. The wood is not used. The fruit is eaten by Nepalese and Lepchas, who also make a wax of it called *Omlu*, Nep.

		lbs.
H 89.	Bhajji, Simla, 5000 ft.	26
H 2942.	Suni, Sutlej Valley, 3000 ft. (Gamble)	27
H 3079.	Annandale, Simla, 6000 ft. „	—
E 2340.	Tukdah, Darjeeling, 5000 ft. „	27

5. **R. punjabensis**, J. L. Stewart; Fl. Br. Ind. ii. 10; Brandis For. Fl. 120. Vern. *Titri, arkhar, palai, choklu, kangar, kakkrein, dor, rashtu, halashang*, Punjab.

A moderate-sized deciduous tree. *Bark* rough, dark grey, ⅜ in. thick, deeply cleft, lenticels prominent, horizontal. *Wood* consisting of alternate layers of soft, porous spring wood and hard autumn wood, yellow or yellowish-grey, with dark longitudinal streaks, soft. *Annual rings* marked by a broad belt of closely packed large pores in the spring wood; the pores in the autumn wood scattered, small or very small, in groups or patches of soft tissue. *Medullary rays* fine, numerous, regular, giving a lustrous silver-grain.

West Himalaya, ascending to 8500 ft., usually in valleys and ravines in moist localities.

A graceful tree with pinnate leaves. Growth slow, 9 to 14 rings per inch of radius. Weight 31 lbs. per cubic foot. Leaves aromatic.

		lbs.
H 3170.	Dungagalli, Hazara (Wild)	—
H 19.	Matiyána, Simla, 8000 ft.	33
H 3051.	Kotgarh, Simla, 7000 ft. (Gamble)	35
H 4451.	Kathian, Jaunsar, 8000 ft. (Gamble)	27
H 4767.	Deota, Tehri-Garhwal, 8000 ft. (Gamble)	30

6. **R. insignis**, Hook. f.; Fl. Br. Ind. ii. 11; Gamble Darj. List 24. Vern. *Kagphulai*, Nep.; *Serh*, Lepcha.

A moderate-sized tree. *Bark* thin, grey. *Wood* grey, soft; heartwood yellowish-brown. *Pores* small and moderate-sized, uniformly distributed. *Medullary rays* fine, numerous.

Sikkim and the Khasia Hills, above 4000 ft., in rather dry localities.

Growth fast, 3 to 4 rings per inch of radius.

		lbs.
E 3104, 3105.	Darjeeling, 7000 ft. (Gamble)	26 and 27

7. **R. Wallichii**, Hook. f.; Fl. Br. Ind. ii. 11. *R. vernicifera*, DC; Brandis For. Fl. 120. Vern. *Kambal, gadúmbal, rikhali, arkhar, arkol, lohása, uruk, harkú*, Punjab; *Akoria, kaunki, bhalíún*, N.-W. P.; *Arkhoi*, Jaunsar; *Kathbhalaia*, Kumaon; *Ulkhuru, khonki*, Garhwal; *Kakbhalâi*, Dotial; *Bhálaio, chosi*, Nep.

A small or moderate-sized tree, exuding, from between the bark and the wood, a black acrid varnish, which draws blisters. Sapwood white, soft; heartwood reddish-brown, yellow when dry (*Brandis*). Structure similar to that of *R. semialata*.

West Himalaya, at 2–7000 ft., in hot dry localities.

The wood is used in the Sutlej Valley for saw-frames and axe-handles. The juice of the leaves is corrosive and blisters the skin.

H 3078. Annandale, Simla, 6000 ft. (Gamble).

H 4826 in the Forest School Collection, Dehra Dún, is marked *R. vernicifera*. The *wood* is bright yellow with white sapwood, and closely resembles that of *R. punjabensis*, but is harder and heavier. *Pores* large, many in spring wood, smaller

and scanty in autumn wood. *Medullary rays* few, distant, giving a pretty silver-grain. Weight, 39½ lbs., locality unknown. It probably is *R. Wallichii*, the description of which may require some modification.

8. R. succedanea, Linn.; Fl. Br. Ind. ii. 12; Roxb. Fl. Ind. ii. 98; Brandis For. Fl. 131. *R. acuminata*, DC; Gamble Darj. List 24. Vern. *Tatri, arkol, titar, lakhar, rikhúl, shash, hurku*, Pb.; *Raniwalai*, Nep.; *Serhnyok*, Lepcha; *Dingkain*, Khasia.

A small deciduous tree. *Bark* thin. *Wood* white when fresh cut, turning brown, shining, soft, with a small yellow heartwood. *Annual rings* marked by a line with large pores. *Pores* otherwise moderate-sized, scanty. *Medullary rays* fine to moderately broad, not numerous.

Himalaya, from the Jhelum to Assam; Khasia Hills, at 2–8000 ft.

The wood is not used. The juice is acrid and causes blisters, the seeds give a good wax, and the tree is planted in Japan along roads and regularly worked for this wax, which is of a snow-white colour, and is made into candles. The valuable Japanese lacquer varnish is obtained by tapping the trees.

		lbs.
H 2907.	Nagkanda, Simla, 7000 ft. (Gamble)	32
H 3167.	Dungagalli, Hazára (Wild)	—
	Nordlinger's Sections, vol. 10.	

2. PISTACIA, Linn.

Contains two Indian species, the second being *P. coccinea*, Coll. and Hemsl. in Journ. Linn. Soc. xxviii. 36, is a small tree of the Shan Hills at 4000 ft. Besides these, *P. Khinjuk*, Stocks, and *P. mutica*, Fisch. and Mey., var. *cabulica*, are common and important small trees of Baluchistan. Lace, in Journ. Linn. Soc. xxviii. 308, says that *P. mutica*, var. *cabulica*, is common on some of the arid stony hills and in dry watercourses at 4–7500 ft. It never forms forests, but occurs scattered, but gregariously, over the ground. It reaches 20 to 25 ft. in height and 6 to 10 ft. in girth. The bark is dark brown with longitudinal fissures, and the wood is very hard, dark and finely grained, and the fruit (*Shnee*) is much prized. Prain, in "Records Bot. Survey of India," i. 125 (1896), gives it as his opinion that *P. cabulica*, Stocks, is a distinct species. *P. Khinjuk* is usually a shrub growing in clefts of limestone rocks between 5000 and 6000 ft., or near Harnai as a tree 20 ft. high, much branched from the base, having a light grey bark, smooth and exfoliating. (*P. mutica*, var. *cabulica* = Vern. *Gwan*, Baluch.; *Khanjak*, Peshin; *Badwan*, Harnai. *P. Khinjuk* = Vern. *Ushgai, buzgai*, Baluch.)

The pistachio nuts (*pista*), which are imported into India from Afghanistan, are the produce of *Pistacia vera*, Linn., a small tree of Western Asia, cultivated in South Europe. Most of the nuts sent to India come from the Badghis District (Aitchison). *P. Lentiscus*, Linn., a shrub of the Mediterranean region, is the true Mastic of Chios. *P. Terebinthus*, Linn., the Terebinth tree, gives the Chio or Cyprus turpentine, and the galls found on it are used in tanning.

1. P. integerrima, J. L. Stewart; Fl. Br. Ind. ii. 13; Brandis For. Fl. 122, t. 22. Vern. *Kaka, kakkar, kakrangche, kakring, kangar, tungu, sish, hurkli*, Pb.; *Kakroi*, Jaunsar; *Karkar, kangar, batkal*, Kashmir; *Kakar singi*, Kumaon; *Shué, sarawan, masua*, Afg.

A deciduous tree. *Bark* rough, grey. *Wood* very hard; sapwood white; heartwood yellowish-brown, beautifully mottled with yellow and dark veins. *Annual rings* marked by a belt of large pores. *Pores* in the rest of the wood very small, forming irregular patches, which are frequently arranged in zigzag lines. *Medullary rays* fine, very numerous.

Suliman and Salt Ranges; outer Western Himalaya, ascending to 6500 ft. and extending east as far as Kumaon. It is chiefly found on dry slopes and in valleys along the rivers.

Growth moderate, 8 to 9 rings per inch of radius. Weight 54 lbs. per cubic foot. The wood is used for furniture, carvings and all kinds of ornamental work. It is usually sold in the hill bazars and particularly at Simla, in the form of thick short planks. The leaves are lopped for fodder for buffaloes and camels, and the galls (*Kakrasingi*) are used in native medicine.

Brandis says that in Kangra, under native rule, the tree was a "badsháhi," or royal tree. The young leaves are red, and the tree, if well grown, is graceful and pretty.

		lbs.
H 160.	Hazara, Punjab (1866)	52
H 926.	Hazara, Punjab (Baden-Powell)	46
H 898.	Murree, Punjab, 7000 ft. (Baden-Powell)	56
H 6.	Julung, Simla, 4000 ft.	—
H 11.	Kombarsen, Simla, 6000 ft.	50
H 2930.	Simla, 6000 ft. (Gamble)	63
H 227.	Garhwal (1868)	60

Nordlinger's Sections, vol. 10 (Tab. V. 4).

2. P. cabulica, Stocks.

A tree. *Bark* grey, very rough, ¼ in. thick, peeling off in small scales. *Wood* very hard, close-grained; sapwood yellowish-white; heartwood purplish-red. *Annual rings* marked by lines of more numerous and larger pores in the spring wood; *pores* in rest of wood small, scanty, in elongated or somewhat oblique strings and surrounded by loose tissue. *Medullary rays* fine, very numerous, rather short. (For Distribution, etc., see above.)

Kuram Valley—Kew Museum (Aitchison, 1881).

3. MANGIFERA, Linn.

About seven species. *M. andamanica*, King in Journ. As. Soc. Beng. lxv. 756, is a tree of the Andaman Islands. Besides the universally cultivated mango, *M. fœtida*, Lour.; Vern. *La-mut*, Burm., is cultivated in South Tenasserim for its fruit, which is, however, much inferior to the mango.

No heartwood. *Wood* soft or moderately hard. *Pores* large, prominent on a vertical section. *Medullary rays* fine, generally closely packed. Occasional, fine, wavy, concentric lines.

1. M. indica, Linn.; Fl. Br. Ind. ii. 13; Roxb. Fl. Ind. i. 641; Bedd. Fl. Sylv. t. 162; Brandis For. Fl. 125; Kurz For. Fl. i. 304; Gamble Darj. List 24; Talbot Bomb. List 61; Trimen Fl. Ceyl. i. 318. The Mango tree. Vern. *Am*, Hind.; *Ghari am*, Ass.; *Jegachu, bocho*, Gáro; *Marka*, Gondi; *Úli*, Kól; *Ama*, Baigas; *Úl*, Sonthal; *Maha*, Khond; *Ambo*, Uriya; *Tsaratpang*, Magh; *Ambe*, Kurku; *Amba*, Mar.; *Mad, mangas*, Tam.; *Mamadi, mamid*, Tel.; *Mavena, mávu, marveen*, Kan.; *Mávu*, Mal.; *Thayet*, Burm.

A large evergreen tree. *Bark* thick, dark grey, nearly black, rough, with numerous small fissures and exfoliating scales. *Wood* grey, in old trees sometimes dark brown with black streaks, and hard; in younger trees, coarse-grained, soft. *Pores* scanty, moderate-sized and large, distinctly marked on a longitudinal section, often subdivided and sometimes joined by short concentric bands. *Medullary rays* fine, wavy, closely packed, interrupted by, or bent round, the pores.

The Mango is found in almost all the forests of the plains of India, here and there, probably marking the sites of old villages or places where people have camped and left the stones. Brandis says, "Indigenous in Burma, along the Ghâts of the western

'coast (extending northwards into Khandésh), in the Khasia Hills, in Sikkim, in ravines 'of the Satpuras;" doubtfully, "in the sub-Himalayan tract, in gorges of the Bahraich 'and Gonda Hills in Oudh, and the outer hills in Kumaon and Garhwal." I have seen it apparently wild in valleys in the hills of Cuddapah in the S. Deccan. Elsewhere, it is cultivated all over India wherever the climate permits, and the soil is good enough.

The wood is used for planking, doors and window-frames, in Calcutta for packing-cases, and in Behar for opium- and indigo-boxes; canoes and masúla boats are made of it. In Dehra Dún and some other tea districts it is in large demand and universal employ for tea-boxes.

Weight 42 lbs. per cubic foot (the specimens); 37 (Puckle); 42 (Skinner, No. 90); 41 (Bourdillon); 42 (Molesworth); 44 (Cunningham); 41 (Baker): the average giving about 41½ lbs. Puckle's three Mysore experiments with bars 2′ × 1″ × 1″ gave P = 587; Cunningham's two experiments with similar bars gave P = 650; Skinner's P = 632; Bourdillon's P = 399; Molesworth's P = 592 and E = 3400; and Baker's, with bars 6′ × 2″ × 2″, P = 471.

Romanis' analysis of the ash (" Ind. For." xii. 73) gave—

	Sapwood.	Heartwood.
Potash	26·98	12·25
Soda	2·72	0·85
Lime	44·80	68·62
Magnesia	11·80	10·49
Oxide of iron	0·64	0·61
Phosphoric acid	12·28	7·18
Sulphuric acid	0·78	—

The Mango has many insect enemies, some of which, like the *úmluri* or *ampotoni* silkworm (*Cricula trifenestrata*, Helfer), which feeds on its leaves in Assam, may be useful to man; but even this gives only a poor silk. The white insect-wax (*Ceroplastes ceriferus*, Sign.) is sometimes found on it; the buds are often completely distorted and the fruit crop ruined by an aphid (*Psylla cistellata*, Buckton, Ind. Mus. Notes, iii. 91); the leaves and shoots are infested occasionally with species of *Idiocerus*; the seeds are attacked by a weevil (*Cryptorhynchus mangiferæ*, Fabr.) which is very destructive; and the fruit is spoilt by dipterous flies (*Dacus ferrugineus*, Fabr. and *Rivellia persicæ*, Bigot). There are doubtless other enemies, especially some of the moths, but a few only have been mentioned. In unsuitable places, young Mango trees suffer from the sun, and in South India, as pointed out by Mr. Higgens in reference to Cuddapah topes, the bark on the western side often gets cracked by hot winds and dries up, when the white ants come and soon make a serious and unsightly wound.

The tree is chiefly grown for the sake of its fruit, which is, with the exception of the plantain, the chief and most important of the fruits of India, and is carefully cultivated, the best kinds being raised from layers and grafts. Plants raised from seed will sometimes produce good fruit, but there is no dependence to be placed on the quality of the fruit of such trees. The seeds do not retain their vitality long, but germinate well if sown when quite fresh.

The bark gives a gum used in medicine; the seed contains gallic acid, and is also so used. The dried kernels of the seeds are eaten in curries or pickled, or ground up, or in other preparations. The fruit is made into preserves and chutnies. The Mango tree is an important one in some of the ceremonies of the Hindus.

The Mango is probably the best tree in India for avenues and for camping "topes," wherever the soil is good and deep enough for it. Trees for avenues and topes are raised from seed, the seeds requiring to be sown when quite fresh. They usually germinate very quickly, sometimes within ten to fifteen days. They may be obtained from May to August, but best in June and July. The plants may be reared in nurseries, though it is better to employ pots or baskets, as the tree has a long tap-root which is liable to be injured in transplanting. In dry localities, the plants require watering for long, perhaps till 10 to 15 ft. high, but in such places it is best not to attempt to plant Mangoes, as they are unlikely to make good trees. The Mango may also be grown by sowing seeds at stake in previously prepared soil, and in many localities, especially where there is sufficiently good soil and moisture enough, this is

probably the best plan. Ribbentrop recommends sowing in boxes in rich soil and transplanting after three months, but in my opinion sowings at stake are better.

		lbs.
O 4901.	Saharanpur District (Gradon)	47
E 637.	Goalpara, Assam (Mann)	48
B 2302.	Assam	38
E 3131.	Calcutta	41
E 1957.	Chittagong (Chester)	39 ✓
D 2053.	Mysore	39 ✓

Nordlinger's Sections, vol. 5.

2. **M. caloneura,** Kurz For. Fl. i. 305; Fl. Br. Ind. ii. 14. Vern. *Tauthayet*, Burm.

An evergreen tree. *Wood* light brown, moderately hard. *Pores* large, scanty, prominent on a vertical section. *Medullary rays* fine, very numerous. Fine, wavy, concentric lines.

Burma, in the low forests on the eastern and southern slopes of the Pegu Yoma.

		lbs.
B 294.	Burma (1867)	38
B 2519.	„ (Brandis, 1862)	32

3. **M. sylvatica,** Roxb. Fl. Ind. i. 644; Fl. Br. Ind. ii. 15; Kurz For. Fl. i. 304; Gamble Darj. List 24. Vern. *Ban am*, Ass.; *Lakshmi am*, Sylhet; *Bagnal*, Mechi; *Chuchi am*, Nep.; *Katúr*, Lepcha; *Sinninthayet*, Burm.

A large evergreen tree. *Bark* thick, grey. *Wood* grey, moderately hard, with numerous wavy, concentric lines. *Pores* large, scanty, prominent on a vertical section. *Medullary rays* fine, indistinct.

Nepal, Sikkim Himalaya, Eastern Bengal and Khasia Hills; rare in Burma. In the Darjeeling District, it is common in the Dulka Jhar forest and in the valleys of the Tista and Great Rangít.

Weight 34 to 41 lbs. The wood has been used for tea-boxes in Assam, but its use was, it is believed, given up since it was discovered that it had the effect of corroding the lead and spoiling the tea (see "Ind. For." ix. 27, 610). The fruit is sometimes eaten, fresh or dried; it is also used medicinally (Roxb.).

		lbs.
E 594.	Khookloong Forest, Darjeeling Terai (Manson)	41
E 952.	Golaghát, Assam (Mann)	34

4. **M. longipes,** Griff.; Fl. Br. Ind. ii. 15; Kurz For. Fl. i. 103. Vern. *Thayet-thini*, Burm.

An evergreen tree. *Bark* brown, smooth except for numerous rounded lenticels. *Wood* light greyish-brown, soft. *Annual rings* marked by a pale line. *Pores* large, often subdivided, scanty, irregularly distributed. *Medullary rays* fine, brown, fairly close.

Freshwater swamp forests of Burma.

One of the characteristic trees of the curious freshwater swamp forests of Burma, such as those between the Hline river and the Irrawaddy, where it is associated chiefly with *Anogeissus acuminata* and *Xanthophyllum glaucum*. For an account of these forests, see Kurz "Prel. Rep. on Veg. of Pegu," p. 29. Kurz mentions that Col. Seaton told him that the trees in these forests are deciduous in the rainy season. So far as I know, the only tree in India proper that has that peculiarity is *Ficus glomerata*.

		lbs.
B 5036.	Pegu Division, Burma	38

5. **M. zeylanica,** Hook. f.; Fl. Br. Ind. ii. 16; Trimen Fl. Ceyl. i. 317. Vern. *Kaddu-ma*, Tam.; *Et-amba*, *wal-amba*, Cingh.

A very large tree. *Bark* rough, brownish-grey. *Wood* greyish-

white, soft. *Pores* moderate-sized to large, often subdivided or in small groups. *Medullary rays* moderately broad to broad.

Low country of Ceylon; endemic.

F. Lewis, in "Ceylon Forester," says that the tree is a great favourite, and that W = 35 lbs. Mendis says the wood is used for brake blocks for railway carriages, packing-cases, coffee and plumbago casks. The fruit is occasionally eaten raw or pickled, but is not good.

	lbs.
No. 142, Ceylon Collection, new (Mendis)	25

4. ANACARDIUM, Rottb.

1. A. occidentale, Linn.; Fl. Br. Ind. ii. 20; Roxb. Fl. Ind. ii. 312; Bedd. Fl. Sylv. t. 163; Kurz For. Fl. i. 310; Talbot Bomb. List 61; Trimen Fl. Ceyl. i. 317. The Cashew Nut tree. Vern. *Kajú*, Hind.; *Hijuli*, Beng.; *Kola mava, mundiri*, Tam.; *Kajú*, Mar.; *Jidi mamidi*, Tel.; *Jidi, kempu geru, godambe*, Kan.; *Geru mavu*, Dharwar; *Thihothayet*, Burm.; *Caju*, Cingh.

A small evergreen tree. *Bark* rough. *Wood* reddish-brown, moderately hard. *Pores* large, filled with pithy substance, prominent on a vertical section. *Medullary rays* fine, dark, interrupted, indistinct.

Originally from America, now established in the coast forests of India, especially in sandy places, and often gregarious.

Growth moderate, 8 to 11 rings per inch of radius. Weight 30 to 38 lbs. per cubic foot; Bourdillon gives W = 30 lbs., P = 317. The wood is used for packing-cases in Ceylon and Burma, for boat-building and charcoal. The nuts are roasted and eaten as dessert. They also give, by expression, a yellow oil similar to almond oil. The pericarp of the fruit gives a black acrid oil which is called "cardol," and gives an acid called "anacardic acid." The oil is very caustic, raises blisters, and is used for warts, corns and ulcers; also to prevent the attacks of white ants to woodwork and of insects to the binding of books. In the Andamans it is used to colour and preserve fishing-lines. The enlarged pedicels of the fruit are also eaten, but are very astringent. Like the mango, it is a food-plant of the silkworm, *Cricula trifenestrata*, Helfer. The tree is best propagated by sowings *in situ*; in S. India it does well as underwood in Palmyra groves; and it is important in coast dune reclamation.

	lbs.
B 2227, 2229. Andamans (Col. Ford, 1866)	38 and 39
D 3934. Nellore Forests (Gamble)	32
W 4624. Travancore (Bourdillon)	30

This specimen is probably only sapwood, it differs by having smaller pores and finer medullary rays.

No. 15, Ceylon Collection, new (Mendis)—wood dark grey, perhaps seasoned in water.

5. BOUEA, Meissner.

1. B. burmanica, Griff.; Fl. Br. Ind. ii. 21; Kurz For. Fl. i. 306. *B. oppositifolia*, Meissn.; Kurz For. Fl. i. 306. *Mangifera oppositifolia*, Roxb. Fl. Ind. i. 640. Vern. *Miriám, uriám*, Beng.; *Mayan*, Burm.

A moderate-sized evergreen tree. *Bark* dark grey. *Wood* grey, hard, with a dark reddish-brown heartwood. *Pores* scanty, moderate-sized, prominent on a vertical section. *Medullary rays* fine, numerous, undulating. Wavy concentric lines dividing the wood into a succession of concentric bands, which may possibly be annual rings.

Sundarbans, Burma and Andaman Islands.

The wood is said by Roxburgh to be very durable; Heinig says it is used for parts of boats above the water-line, in the Sundarbans. It is on his authority that it is given as a Bengal tree. The tree has an edible fruit, for which it is often cultivated.

	lbs.
B 2213. Andamans (Col. Ford, 1866)	55

6. GLUTA, Linn.

Three species, of which one is South Indian and the others from Tenasserim and the Andaman Islands. They afford woods which are among the most beautiful of the timbers of India, but are unfortunately not sufficiently common to be regular trade timbers. They are well worthy of cultivation in the localities suitable for them, and then perhaps in the future they may appear in the markets of Europe and America. No one who has ever seen these woods can doubt that, when once well known and procurable in sufficient quantity and regularly, they would take as high a place as Mahogany in the trade. *G. elegans*, Wall.; Fl. Br. Ind. ii. 22; Kurz For. Fl. i. 310; var. *Helferi*, Hook. f., is a small evergreen tree of the coast of Tenasserim. Kurz says of it, "Wood good for furniture, and when steeped in ferruginous mud, turns jet 'black, looking like ebony. Used also for building purposes, boxes, etc., and for dyeing, 'with different mordants, from orange to black."

Wood dark red, more or less streaked with orange and black. *Pores* few, often filled with resin, large, prominent or vertical sections. *Medullary rays* very fine. Interrupted, very narrow, undulating concentric bands.

1. **G. tavoyana,** Wall.; Fl. Br. Ind. ii. 22; Kurz For. Fl. i. 309. Vern. *Chay, thoomay*, Karen; *Thayetthitse*, Burm.

An evergreen small tree. Heartwood dark red, streaked with dark and light streaks, but rather less so than that of *G. travancorica*. *Pores* moderate-sized to large, scanty, often filled with resin. *Medullary rays* very fine, very numerous and regular, the distance between them much less than the transverse diameter of the pores. Light, very narrow undulating concentric bands, occasionally interrupted.

Coast forests of Tenasserim, from Tavoy southwards.

Col. Seaton (Burma Forest Report, 1880–81) gives W = 67 lbs. for the timber, but the specimen examined, though a good one, only gives 52 lbs. The wood is said to be durable, but brittle. It is a fine wood, and the tree is worthy of protection and care, as it might give, at any rate, a turnery wood, if not sufficiently large or abundant to be fit for export for furniture. Two door panels of this wood exhibited at Paris in 1900 were much admired, though they had suffered in beauty by having been oiled.

		lbs.
B 3701.	Tenasserim (H. C. Hill, 1882)	52
B 4844.	"	48

2. **G. travancorica,** Bedd. Fl. Sylv. t. 60; Fl. Br. Ind. ii. 22. Vern. *Shencurungi*, Tinnevelly; *Shenkurani, shenchanthanam*, Tam.

A very large evergreen tree. *Bark* ⅓ in. thick, grey. Sapwood light reddish-grey; heartwood dark red, very hard and close-grained, beautifully mottled with dark and light, *i.e.* black and orange, streaks. *Pores* moderate-sized, scanty, filled with resin. *Medullary rays* very fine, very numerous, prominent, visible in the silver-grain as narrow bands. Numerous pale, undulating, concentric lines, often interrupted.

Dense moist forests on the hills of Travancore and Tinnevelly, ascending to 4000 ft. Beddome says it is most abundant above Papanásam, in the Tinnevelly District.

Beddome says that this tree grows to a great height, with a very straight bole and to a girth of 15 ft.

Growth moderate, 12 rings per inch of radius. Weight, according to Beddome, 40 lbs. per cubic foot; specimens examined give an average of 53 lbs.; Bourdillon gives 53 lbs. The wood is little used, but its splendid colour and markings should rapidly bring it to notice as a valuable wood for furniture, and it is a great pity that its range is so small. It seems to season very well, and works and polishes admirably,

and is distinctly one of the finest and most beautiful woods of India. The tree is deserving of every encouragement in the forests where it is indigenous, and ought to be specially recognized and provided for in Working Plans, and perhaps planted.

		lbs.
W 1065.	Tinnevelly (some sapwood) (Beddome)	46
W 3155.	" (heartwood only)	58
W 4031, 4290.	Tinnevelly (Brasier)	51 and 56
W 4540.	Travancore (Bourdillon)	55

7. BUCHANANIA, Roxb.

Nine species. One is common almost all over India; another frequent in South India, with a third less common; the rest are all Burmese or Andaman trees. *B. acuminata*, Turcz; Fl. Br. Ind. ii. 24; Kurz For. Fl. i. 308, is a common tree in Tenasserim. *B. platyneura*, Kurz; King in Journ. As. Soc. Beng. lxv. ii. 748, is a common tree in the Andaman and Nicobar Islands. *B. lancifolia*, Roxb. Fl. Ind. ii. 386; Fl. Br. Ind. i. 24; Kurz For. Fl. i. 309; Vern. *Thinbaung*, Burm., is a large evergreen tree of tropical forests in Chittagong, Arracan, Burma and the Andamans. *B. lanceolata*, Wight; Fl. Br. Ind. ii. 24, is a small tree of deciduous forests in Travancore. *B. glabra*, Wall.; Vern. *Thittwet*, Burm., *B. lucida*, Blume (*B. arborescens*, Bl.; Kurz For. Fl. i. 308), and *B. laxiflora*, Kurz, are Burmese trees.

Wood greyish-brown, moderately hard. *Pores* large, scanty, prominent on the vertical sections. *Medullary rays* numerous, fine, reddish.

1. **B. latifolia,** Roxb. Fl. Ind. ii. 385; Fl. Br. Ind. ii. 23; Bedd. Fl. Sylv. t. 165; Brandis For. Fl. 127; Kurz For. Fl. i. 307; Talbot Bomb. List 62. Vern. *Chirauli*, Pb.; *Piál, payála, muriá, kathhilawa*, Garhwal; *Piár, peirah, perua*, Oudh; *Achár, chár, chironji*, C.P.; *Saraka, herka*, Gondi; *Taro*, Kurku; *Charu*, Uriya; *Paróp*, Sonthal; *Chár*, Merwara; *Kat maá, aima, morála*, Tam.; *Chara, chinna moral, morli*, Tel.; *Charwari*, Hyderabad; *Nurkul, murkalu*, Kan.; *Sir*, Bhil; *Pyal, charoli*, Bombay; *Jaru mamidi*, Palkonda; *Tarúm*, Kól; *Piál*, Bhumij; *Peea*, Kharwar; *Múngapera*, Mal.; *Mora kangi, múra*, Trav. Hills; *Lônbo*, Burm.

A tree, leafless only for a short time. *Bark* 1 in. thick, dark grey, sometimes nearly black, rough, tessellated with regular "boss"-like prominences. *Wood* greyish-brown, moderately hard, with a small dark-coloured heartwood. *Pores* large, round or oval, scanty, frequently subdivided, prominent on a vertical section. *Medullary rays* very numerous, fine, reddish, uniform and equidistant, bent outwards where they touch the pores, and giving a silver-grain of narrow dark-coloured plates.

Dry forests throughout India and Burma; in North-West India from the Sutlej to Nepal, ascending to 3000 ft. and common both in the Sál forests and on dry outer Himalayan and Siwalik slopes; Central Provinces, Behar, Chota Nagpore, Orissa, the Circars, the Mahratta country, Deccan and Carnatic; open and dry forests especially with "Eng" all over Burma.

Its characteristic bark makes this tree conspicuous wherever it is found. On dry hills like the Siwalik Range it is very useful in covering the ground, and it is equally at home on newly formed landslips as on gentle slopes with fairly good soil. The wood is of poor quality, and I do not remember to have seen it used, or known it to be in demand, even as fuel. Brandis, however, says, "Used for boxes, bedsteads, bullock-'yokes, doors, window-frames, tables and the like;" and Beddome also says it is used for bullock-yokes and other purposes and for charcoal. Brandis says the wood will stain clothes unless polished, and that the bark is used for tanning. It gives a gum copiously in large irregular pieces; this gum is only partially soluble in water (about 10 per cent. insoluble), but what is soluble gives a good mucilage, and it has been reported as likely to be useful for cheap manufacturing purposes, and valued at 20s. per cwt. The fruit has an edible kernel, eaten by hill tribes in Central India, also by Europeans sometimes for dessert, and used in native sweetmeats. The kernels, which

resemble Pistachio nuts, are the part eaten: they also give an oil. Analysis of the wood ashes gave 1·44 per cent. ash in 100 lbs. steam-dry wood; and of the ash 33 per cent. proved to be calcium carbonate, 27 per cent. magnesium carbonate and 20 per cent. potassium and sodium compounds.

Brandis (Burma List, 1862, No. 108) gives W = 36 lbs.; Bourdillon gives also 36 lbs. and P = 452; the specimens give an average of 33 lbs.

		lbs.
O 245.	Garhwal (1868)	35
C 1124.	Ahiri Reserve, Central Provinces (R. Thompson) . . .	29
C 2751.	Moharli " " (Brandis)	36
C 2763.	Melghát, Berar (Brandis)	—
C 1249.	Gumsúr, Madras (Dampier)	32
C 3532.	Khurdha Forests, Orissa (Gamble)	34
C 4216.	Ganjam Forests (Gamble)	31

2. B. angustifolia, Roxb. Fl. Ind. ii. 386; Fl. Br. Ind. ii. 23; Bedd. Fl. Sylv. lxxix.; Talbot Bomb. List 62; Trimen Fl. Ceyl. i. 386. Vern. *Sara, chara, peddamoráli,* Tel.

A tree. *Bark* black-brown, ½ to ⅔ in. thick, rough, tessellated with deep irregular cracks. *Wood* greyish-brown, moderately hard. *Pores* large, scanty, sometimes subdivided. *Medullary rays* very numerous, uniform and equidistant, the distance between them less than the transverse diameter of the pores.

South India, in the forests of the Deccan and Carnatic, also in the Konkan and South Mahratta country; dry forests in Travancore; low country of Ceylon, where scarce. It is chiefly found on dry hill slopes.

The wood is not used. The nuts are eaten in the same way as those of *B. latifolia,* to which they are superior. When freshly extracted, the kernels are excellent, but they soon get rancid if kept; like Pistachio nuts, they are usually eaten roasted. They are known as "*Sara pappu*" in the Deccan.

		lbs.
D 4229.	Cuddapah Forests (Higgens)	43

8. MELANORRHŒA, Wall.

Contains two species: that here described and *M. glabra,* Wall.; Fl. Br. Ind. ii. 25; Kurz For. Fl. i. 317; Vern. *Thitsi,* Burm., a tree of Tenasserim.

1. M. usitata, Wall.; Fl. Br. Ind. ii. 25; Kurz For. Fl. i. 318. The Varnish Tree of Burma. Vern. *Kheu,* Manipur; *Thitsi,* Burm.; *Soothan,* Taleing; *Kiahong,* Karen.

A deciduous tree. *Bark* dark grey. *Wood* dark red with yellowish streaks, turning very dark after long exposure; very hard. *Pores* moderate-sized, scanty, often subdivided; each pore or group of pores enclosed in a small patch of light tissue. *Medullary rays* very fine, wavy, very numerous. Numerous undulating, often interrupted, very narrow, concentric lines of soft tissue, unequally distributed in the wood.

Manipur and Burma, chiefly in open forests like those of Eng, rare in dry forests.

This tree also gives a handsome wood worthy of being better known and in more demand. It is heavier than, but not unlike that of *Gluta.*

The following experiments have been made to determine the weight and transverse strength:—

	Weight in lbs.	Value of P.
Benson in Burma, with bars 3′ × 1·4″ × 1·4″, found . .	61	526
Skinner, in 1862, No. 91 . . . . . " . .	61	514
Brandis' Burma List, 1862, No. 44, also Kurz, " . .	54	—

The wood is used for tool-handles, anchor stocks, and has been recommended for building, railway sleepers, gun-stocks and other purposes (Kurz). It gives a black

varnish, used to cover buckets to make them watertight. This vanish is used by the Burmese in lacquer-work, as size in gilding, for writing in palm-leaf books and other purposes. It has been used as medicine as an anthelmintic with success (see also Brandis in Ind. For. i. 362, also Ind. For. xviii. Appx.).

		lbs.
B 551.	Moulmein, Burma (Seaton)	56
B 2518.	Burma (Brandis, 1862)	62

Nordlinger's Sections, vol. 8 (Tab. V. 5).

B 3704, sent by H. C. Hill from Tenasserim in 1882 under the name *Thitsibo*, is clearly the wood of a *Melanorrhœa*, and differs only from that of *M. usitata* by being rather lighter coloured, and having the pores more scanty and the concentric lines further apart. It may belong to *M. glabra*, Wall.

9. SWINTONIA, Griff.

Three species. *S. Griffithii*, Kurz and *S. Helferi*, Hook. f.; Fl. Br. Ind. ii. 26; Kurz For. Fl. i. 316, are large evergreen trees of Tenasserim, the latter extending to the Andaman Islands.

1. **S. Schwenckii**, Teysm. and Binnend.; Fl. Br. Ind. ii. 26; Kurz For. Fl. ii. 316. Vern. *Boilam, boilsur*, Beng.; *Sambúng, sanginphroo*, Magh; *Shibika*, Chakma; *Thayetkin, thayetsan*, Burm.

A tall tree with cylindrical bole. *Bark* grey, often nearly white, smooth but with shallow vertical fissures, $\frac{1}{4}$ in. thick. *Wood* greyish-white, soft, even-grained. *Pores* moderate-sized, scanty. *Medullary rays* moderately broad to broad, long, numerous, regular, giving a conspicuous silver-grain.

Chittagong and Burma, along rivers and in tropical forests.

In the Chittagong forests, this is one of the most conspicuous trees, especially along the banks of the Karnafuli river. Its tall grey straight bole, often as high as 80 ft. without a branch, and its spreading head, make it very conspicuous. In the cold season the foliage has a tinge of red. The wood seems of fair quality for a soft wood. Major Lewin says it lasts better than other woods in salt water.

		lbs.
E 1964.	Chittagong Hill Tracts (Chester)	— (lost)
E 4885.	„ „ (Stebbing)	38 (doubtful)
E 4927.	„ „ (A. H. Mee)	46

The last a fine specimen, from which the description is taken.

10. SOLENOCARPUS, W. and A. *S. indica*, W. and A.; Fl. Br. Ind. ii. 27; Bedd. Fl. Sylv. lxxix. t. 233; Talbot Bomb. List 62, is a tree of the hills of Western India, from the evergreen forests of Yellapur in N. Kanara to the Palghát, Anamalai and Tinnevelly hills up to 2500 ft.

11. TAPIRIA, Juss. This genus only contains one climbing shrub of the Eastern Himalaya and Eastern Bengal down to Chittagong. *T. hirsuta*, Hook. f.; Fl. Br. Ind. ii. 28; Kurz For. Fl. i. 320; Gamble Darj. List 24; Vern. *Mashul*, Nep.; *Renchiling*, Lepcha.

12. ODINA, Roxb.

1. **O. Wodier**, Roxb. Fl. Ind. ii. 293; Fl. Br. Ind. ii. 29; Bedd. Fl. Sylv. t. 123; Brandis For. Fl. 123; Kurz For. Fl. i. 321; Gamble Darj. List 24; Talbot Bomb. List 62; Trimen Fl. Ceyl. i. 318. Vern. *Kiamil, kimúl, kamlái, kashmala, jhingan, mowen, mohin, moyen, moyna, ginyan*, Hind.; *Jigna*, Oudh; *Garja*, Bijeragogarh; *Bara dabdabbi, halloray*, Nep.; *Jiyal, lohar bhadi*, Beng.; *Gob*, Ajmere; *Gol*, Merwara; *Wodier, uude, uthi, odi*, Tam.; *Gumpini, gumpina, gumpna, dumpini, dumpri, dumper*, Tel.; *Kaikra, gumpri, gharri*, Gondi; *Kekeda*, Kurku; *Shimti, púnil, gojal*, Kan.; *Moi, moja, moye, shimbat, shimti*, Mar.; *Kalasan*, Mal.; *Jir, jiyál*, Monghyr; *Dowka*, Sonthal, Kól; *Dowka gia*, Bhumij; *Moi*, Uriya; *Dopé*, Khond; *Hneingpyoing*, Magh; *Nabè, hnabè*, Burm.; *Hik*, Cingh.

A moderate-sized or large deciduous tree. *Bark* ½ in. thick, compact, grey, smooth, exfoliating in small irregular plates. *Wood* moderately hard, close-grained; sapwood large; heartwood light red when fresh cut, turning reddish-brown on exposure. *Pores* moderate-sized, uniformly distributed, scanty, often subdivided. *Medullary rays* fine, short, bent where they touch the pores.

Dry forests in most parts of India and Burma; from the Indus eastwards it is found in the Lower Himalaya and along valleys up to 4000 ft., also in the sub-Himalayan forests, away to Assam; throughout Central India, the East and West Coast regions and South India, especially in dry places; all deciduous forests in Burma; Ceylon and the Andamans; very commonly planted.

In dry localities this is merely a small tree of somewhat ungainly appearance, the ungainliness often accentuated by the knobs on the stem, the result of tappings for gum. But in places where, as in the Sál forests and mixed forests at the foot of the hills, it meets with more moisture and more companions, it grows into a handsome spreading tree; and it is only then that its really valuable heartwood is formed in sufficient amount to be useful.

The following experiments have been made to determine the weight and transverse strength:—

		Weight in lbs.	Value of P.
Skinner, No. 101, 1862	found	50	821
Benson, Burma wood, bars 3′ × 1·4″ × 1·4″ . .	„	60	281
Brandis, No. 46, Burma List, 1862	„	65	—
Bennett, No. 11, 1872, 3 experiments with bars 3′ × 1½″ × 1½″	„	59	483
H. H. O'Connell, 1886, Madras	„	54	—
Bourdillon, Travancore, 1896	„	60	673
Specimens examined average		48	—

The wood is used for spear-shafts, scabbards, wheel-spokes, cattle-yokes, oil-presses and rice-pounders; it might be good for cabinet work (Brandis). It has been tried for sleepers both in Madras and in the Oudh and Rohilkhand Line, but has not succeeded. The tree is pollarded for fodder, especially for elephants; its bark is used for tanning; it gives a brown, clear, brittle gum used by the Nepalese as paper-sizing, by weavers in cloth-printing, and in native medicine. With regard to this gum, Captain Campbell, writing from Kumaon, says, "It sells at Rs.2 per maund, and is used in mixing with 'lime when whitewashing; it is also used for pasting, and is exported annually to the 'amount of about 100 maunds from Garibolchand forest in the Kumaon Bhabar." The gum is found in irregular angular or, more often, rounded pieces obtained by making shallow short cuts all over the bark. Specimens examined at the Imperial Institute in 1895 were found to be soluble in twice their weight of water, and to have about three-fourths of the viscosity of a similar solution of gum arabic. They were valued at 20*s.* to 25*s.* per cwt., so that the gum is undoubtedly an important one.

The wood, like that of Sál (pp. 80, 81), is frequently attacked by the Cerambycid beetle, *Plocederus obesus*, Daporet, the larva of which, when pupating inside the wood, forms a hard egg-like cocoon, over 1 in. long and of an oblong, somewhat flattened shape.

Odina is often grown as an avenue tree, but has the disadvantage of being leafless in the hot season. I have, however, seen it along roads in Madras, in leaf, at that season, and this seems to demand inquiry. It is easily propagated either by seed or by cuttings, but seeds must be sown at once and not kept, as they rapidly lose vitality.

		lbs.
H 3049.	**Kumbarsen, Sutlej Valley, 2500 ft. (sapwood) (Gamble)** . .	**35**
P 447.	**Ajmere**	**43**
P 3225.	**Nagpahar, Ajmere**	**—**
O 226.	**Garhwal (1868)**	**38**
O 2992.	**„ (1874)**	**41**
C 202.	**Mandla, C.P. (1870)**	**38**
C 1103.	**Ahiri Reserve, C.P. (R. Thompson)**	**48**
C 3529.	**Khurdha Forests, Orissa (Gamble)**	**66**
D 4246.	**Nallamalai Hills, Kurnool „**	**47**
E 661.	**Bamunpokri, Darjeeling Terai (Manson)**	**46**

		lbs.
E 2342.	Bamunpokri, Darjeeling Terai (Gamble)	48
E 1399.	Chittagong (Chester)	44
E 1965.	" "	61
B 1414.	Tharrawaddy, Burma	64
B 2517.	Burma (Brandis, 1862)	35
B 516.	Andaman Islands (Gen. Barwell)	60

Nordlinger's Sections, vol. 9 (Tab. V. 6).

13. PARISHIA, Hook. f. *P. insignis*, Hook. f.; Fl. Br. Ind. ii. 30; Kurz For. Fl. i. 318, is a large evergreen tree of Tenasserim and the Andaman Islands.

14. SEMECARPUS, Linn. f.

About 24 species, no less than 12 of which are endemic Ceylon trees, mostly rare. *S. subpanduriformis*, Wall.; Fl. Br. Ind. ii. 35; Kurz For. Fl. i. 313, is a tree of the mixed forests of Chittagong and Arracan. *S. subspatulata*, King in Journ. As. Soc. Beng. lxv. ii. 12, is a small tree of Upper Burma. *S. pandurata*, Kurz For. Fl. i. 312; Vern. *Che*, Burm., is a common tree in the upper mixed forests of Burma, with a wood and fruit similar in properties to those of *S. Anacardium*, which it replaces. The rest, except those here described, are more or less scarce trees of Burma and the Andamans.

1. **S. Anacardium**, Linn. f.; Fl. Br. Ind. ii. 30; Roxb. Fl. Ind. ii. 83; Bedd. Fl. Sylv. t. 166; Brandis For. Fl. 124; Kurz For. Fl. i. 312; Gamble Darj. List 25; Talbot Bomb. List 62. The Marking-nut tree. Vern. *Bhilawa*, *bheyla*, Hind.; *Bhalai*, Nep.; *Bhela*, *bhelatuki*, Beng.; *Bhallia*, Uriya; *Kongki*, Lepcha; *Bawaræ*, Gáro; *Soso*, Sonthal, Kól; *Bhilwa*, Baigas; *Shidi*, Palkonda; *Choso*, Melghát; *Kokha*, *biba*, Gondi; *Shaing*, *shayrang*, *shengkotta*, *thembarai*, Tam.; *Jiri*, *jidi*, *nella-jedi*, Tel.; *Bibha*, *bibu*, Mar.; *Gheru*, *kari gheru*, *ger*, Kan.; *Sambiri*, Trav. Hills; *Bibwa*, *bibu*, Mar.

A deciduous tree, bark ⅓ in. thick, dark brown, rough, exfoliating in very irregular inner patches; inner bark fibrous. *Wood* greyish-brown, often with yellow streaks, soft, no annual rings. *Pores* scanty, moderate-sized, frequently subdivided, well marked on a vertical section, sometimes joined by lines of soft tissue. *Medullary rays* numerous, moderately broad, reddish; prominent in the silver-grain as long, narrow, dark-coloured plates.

Sub-Himalayan tract from beyond the Sutlej eastwards, ascending to 3500 ft.; nowhere gregarious, but scattered in grass lands or in forests, extending to Chittagong, but not to Burma or to Ceylon.

The tree is easily recognized in forest by its large leaves and by the fruits, which consist of an oblong oblique drupe with a thick black pericarp, between the layers of which are the cells containing the corrosive juice which forms the marking-ink. The ink is improved by the addition of lime-water. The drupe is seated on a yellow astringent hypocarp, which is sometimes eaten, usually either dried or roasted. The green fruit is pounded and made into birdlime (Bedd.). The tree gives a brown gum of little or no value.

Weight 42 lbs. per cubic foot (Brandis); 37 lbs. (Wallich, *Anacardium latifolium*, No. 4); 27 lbs. (Kyd); the average of specimens examined gave 37 lbs. Kyd's experiments with bars of Assam wood 2′ × 1″ × 1″ gave P = 197; Bourdillon found W = 35 lbs., P = 230. The wood contains an acrid juice which causes swelling and irritation, and timber-cutters object to felling it; it is not used.

		lbs.
C 1157.	Ahiri Reserve, Central Provinces (R. Thompson)	44
C 2746.	Moharli " " (Brandis)	40
E 578.	Khookloong Forest, Darjeeling Terai (Manson)	39
E 627.	Bamunpokri " " "	30
E 2341.	" " " (Gamble)	33

The Ahiri specimen, C 1157, has pores joined by irregularly shaped soft tissue across the medullary rays, and has a harder and closer-grained wood than the Darjeeling specimens; the bark is, however, that of *S. Anacardium*, and there is no reason to

doubt its identity. The specimens from Darjeeling are marked by the absence of the lines of soft tissue joining the pores.

2. **S. travancorica,** Bedd. Fl. Sylv. t. 232; Fl. Br. Ind. ii. 31. Vern. *Natu shengoti, katha shengkotta,* Tam.; *Then chera,* Trav. Hills; *Shéra,* Kader.

A very large tree. *Wood* grey or greyish-white, soft. *Pores* moderate-sized to large, scanty. *Medullary rays* brown, moderately broad, short.

Moist forests of the Travancore and Tinnevelly Ghâts at 2–3000 ft.

The fruit has the same properties as that of *S. Anacardium.* Bourdillon gives W = 28 lbs., P = 425; the specimens give an average weight per cubic foot of 26 lbs.

		lbs.
W 4292.	Tinnevelly (Brasier)	22
W 4602.	Travancore (Bourdillon)	30

3. **S. auriculata,** Bedd. Fl. Sylv. under t. 232; Ic. Pl. Ind. Or. t. 187; Fl. Br. Ind. ii. 32. Vern. *Velleicharie,* Tam.

A large tree. *Wood* reddish-grey, soft. *Pores* moderate-sized and large, often subdivided, prominent on a radial section. *Medullary rays* fine, moderately numerous, bent where they touch the pores.

Ghâts of Tinnevelly and Travancore, up to 2000 ft., discovered by Mr. Hayne. Bourdillon gives W = 28 lbs., P = 404.

		lbs.
W 4616.	Travancore (Bourdillon)	25

15. DRIMYCARPUS, Hook. f.

1. **D. racemosus,** Hook. f. in Fl. Br. Ind. ii. 36; Kurz For. Fl. i. 314; Gamble Darj. List 26. *Holigarna racemosa,* Roxb. Fl. Ind. ii. 82. Vern. *Kagi,* Nep.; *Brong,* Lepcha; *Telsur,* Beng.; *Amdali,* Ass.; *Chengane, sangaipru, sangryn,* Magh; *Amjour,* Sylhet.

A large evergreen tree. *Wood* greyish-yellow, hard, close-grained. *Pores* large and moderate-sized, sometimes subdivided, each pore in a narrow white ring. *Medullary rays* short, moderately broad, uniform and equidistant, joined by innumerable faint, transverse lines.

Eastern Himalaya at 2–6000 ft.; Khasia Hills and Sylhet to Chittagong; tropical forests of the Pegu Yoma; Andaman Islands.

The wood is used occasionally in Assam for canoes and planking; in Chittagong for boats, for which it is one of the woods most employed. Major Lewin says that boats 50 ft. long and 9 ft. in girth are sometimes cut.

		lbs.
E 722.	Chittagong (Chester)	61

16. HOLIGARNA, Ham.

Five species. *H. ferruginea,* March.; Fl. Br. Ind. ii. 37; Vern. *Charei, karun charei,* Tam.; *Chera,* Mal., is a large tree of evergreen forests and near water in the Western Ghâts from Coorg to Travancore. Bourdillon says it has a white wood with black acrid blistering juice. *H. Grahamii,* Hook. f. in Fl. Br. Ind. ii. 37; Talbot Bomb. List 63, is a tree of the Western Coast in the Konkan and N. Kanara, common from Ainshi Ghât southwards, on to Travancore. On the subject of the acrid juice given by the Holigarnas, cf. D. Hooper in *Pharm. Journal,* June, 1895 (also Ind. For. xxi. 478).

Wood soft, greyish. *Pores* large, prominent on a vertical section. *Medullary rays* fine, short, not prominent.

1. **H. Arnottiana,** Hook. f. in Fl. Br. Ind. ii. 36; Talbot Bomb. List 63. *H. longifolia,* W. and A.; Bedd. Fl. Sylv. t. 167. Vern. *Kagira, holigar, hoolgeri, kootigheri,* Kan.; *Sudrabilo,* Mar.

A large tree. *Wood* light grey, soft, light. *Pores* large, scanty, often subdivided, prominent on a vertical section. *Medullary rays* fine, short, not numerous.

Western Coast, in the forests near the sea and on the Ghâts behind, in the Konkan, Kanara, Malabar and Nilgiris.

Beddome says he understands that the wood is sometimes used for house-building and to make boats. The wood gives a very acrid black juice, which is used as a varnish. Bourdillon gives W = 27 lbs., P = 343. Graham-Anderson says that toddy cats are fond of the fruit.

	lbs.
W 4676. Travancore (Bourdillon)	23

2. **H. Beddomei,** Hook. f. in Fl. Br. Ind. ii. 38.

An enormous tree. *Wood* precisely similar to that of *H. Arnottiana.*

Western Ghâts, Anamalai and Travancore Hills.

	lbs.
W 4715. Travancore (Bourdillon)	26

W 4603 from Travancore (Bourdillon) is the wood of a species of *Holigarna* (perhaps *H. ferruginea,* March.). *Wood* soft, reddish-grey. *Pores* large, scanty. *Medullary rays* moderately broad, not numerous, reddish, giving a pretty silver-grain. W = 30 lbs. Bourdillon gives W = 22 lbs., P = 418.

3. **H. Helferi,** Hook. f. in Fl. Br. Ind. ii. 37; Kurz For. Fl. 215. *H. longifolia,* Roxb. Fl. Ind. ii. 80; Fl. Br. Ind. ii. 37 (*fide* Kurz and Engler). Vern. *Barola,* Beng.; *Khreik,* Magh.

An evergreen tree. *Wood* grey, with yellowish streaks, soft. *Pores* moderate-sized, often subdivided, uniform, scanty, prominent as dark lines on a vertical section. *Medullary rays* fine, white, short, equidistant.

Forests of Chittagong and Burma, chiefly along streams.

Wood not used. It contains a black acrid exudation which raises blisters, and is much dreaded. The Maghs who were with me when I cut the specimen at first refused to touch it or to have it in the canoe with us.

E 3287. Rinkheong Forest, Chittagong Hill Tracts (Gamble).

17. NOTHOPEGIA, Bl.

Three species. *N. travancorica,* Bedd. and *N. aureo-fulva,* Bedd.; Fl. Br. Ind. ii. 40, are trees of Travancore and Tinnevelly, the latter occurring also in S.-E. Wynaad.

1. **N. Colebrookiana,** Bl.; Fl. Br. Ind. ii. 40; Bedd. Fl. Sylv. t. 164; Talbot Bomb. List 63; Trimen Fl. Ceyl. i. 325. Vern. *Amberi,* Bombay; *Bala,* Cingh.

A tree. *Bark* thin, brown, rather shining, cracked in irregular flakes. *Wood* pinkish-yellow, with a satiny lustre, hard, close-grained. *Pores* small, scanty, evenly distributed, joined by narrow, wavy, pale concentric lines. *Medullary rays* fine, pale, numerous.

Eastern and Western Ghâts and hills of the Deccan; on the east, on Mahendragiri, N. Circars, 4000 ft., and at similar elevations southwards; on the west, in the evergreen forests of the Konkan and N. Kanara, and south to the Nilgiris and Travancore, up to 5000 ft.; moist region of Ceylon..

The wood is strong, but scarce and not used. The fruit is like a plum, edible.

	lbs.
D 3860. Horsleykonda, Cuddapah, 4500 ft. (Gamble)	62

18. CAMPNOSPERMA, Thw. *C. zeylanicum,* Thw.; Fl. Br. Ind. ii. 41; Bedd. Fl. Sylv. t. 168; Trimen Fl. Ceyl. i. 326; Vern. *Aridda,* Cingh., is an endemic Ceylon

tree, sometimes gregarious, found in the moist low country, and having the "*wood* '*white, smooth, rather light and soft, coarse-grained, of little use except for tea-boxes,* '*for which it is said to be very good*" (Trimen). No. 7, Ceylon Collection, new (Mendis) is "*Aridda*," and may be this, but the wood is greyish-brown and seems doubtful.

TRIBE II. SPONDIEÆ.

19. SPONDIAS, Linn.

Three species. *S. acuminata*, Roxb. Fl. Ind. ii. 453; Fl. Br. Ind. ii. 42; Talbot Bomb. List 63; Vern. *Ambút, ambada*, Mar., is a handsome tree of the hills of West and South India. Graham says it is found in the Konkan Hills near the Kennery caves and in N. Kanara. I have myself seen it frequently in Wynaad. It is used occasionally as shade for coffee, and is probably the *Gwoddan* of Graham Anderson's List, p. 7. The fruit is occasionally eaten. *S. dulcis*, Willd., the "Otaheite apple" with a large fruit, the best kinds of which are pleasant to eat, is sometimes cultivated in India.

1. **S. mangifera**, Pers.; Fl. Br. Ind. ii. 42; Roxb. Fl. Ind. ii. 451; Bedd. Fl. Sylv. t. 169; Brandis For. Fl. 128; Kurz For. Fl. i. 322; Gamble Darj. List 25; Talbot Bomb. List 63; Trimen Fl. Ceyl. i. 327. The Hog Plum. Vern. *Amra, amara, ambodha*, Hind.; *Ambar*, Oudh; *Amara*, Nep., Ass.; *Amra*, Beng.; *Ronchiling*, Lepcha; *Tongrong, adai*, Gáro; *Kat mán, ampallai*, Tam.; *Aravi mamadi, amatum*, Tel.; *Kat ambolam*, Mal.; *Amb*, Mar.; *Amte, amate, amti, gwoddan*, Kan.; *Hamára*, Gondi; *Ambera*, Kurku; *Ambola*, Uriya; *Ambeti, leina*, Khond; *Ambada*, Mar.; *Katamba, kekda*, Berar; *Ambalam*, Mal.; *Ambayam, mámpuli*, Trav. Hills; *Embarella*, Cingh.; *Puli ille*, Kader; *Gwè*, Burm.

A large deciduous tree. *Bark* smooth, grey, with short, shallow, longitudinal wrinkles. *Wood* soft, light grey. *Pores* large, numerous, often subdivided. *Medullary rays* fine and moderately broad, at unequal distances, white, prominent, distinctly marked as long narrow plates in the silver-grain.

Dry forests in many parts of India and Burma, nowhere very common; from the Salt Range in the Punjab along the lower Himalaya, sub-Himalayan tract and Himalayan valleys to Assam and Eastern Bengal; Central and Western and Southern India and the Deccan; mixed forests in Burma up to 3000 ft.; Andaman and Cocos Islands; moist low country of Ceylon; often planted.

A handsome tree, quickly and easily grown, the leaves recognized by the intramarginal nerve. The wood is useless; Skinner, No. 116, gives W = 43 lbs. and P = 614; Bourdillon gives W = 22 lbs. and P = 293; the specimens give an average of 26 lbs. It gives an insipid gum somewhat resembling gum arabic, but darker. The fruit is eaten, more usually pickled or made into curries; it is also used in medicine, as are the leaves. The Cerambycid beetle, *Plocederus obesus* (see also under *Odina Wodier*), often attacks the wood; and the Chrysomelid beetle, *Podontia 14-punctata*, Linn., defoliates the tree, doing great damage.

		lbs.
C 2800.	Melghát, Berar (Brandis)	—
E 499.	Khookloong Forest, Darjeeling Terai (Manson)	30
E 1296.	Cachar (Vern. *Túndúr*)	21
E 1497.	Sylhet (Vern. *Sutrung*)	25
B 560.	Burma (Ribbentrop)	29

2. **S. axillaris**, Roxb. Fl. Ind. ii. 453; Fl. Br. Ind. i. 42. *S. acuminata*, Gamble Darj. List 25 (*non* Roxb.), Vern. *Labshi*, Nep.

A large tree. *Wood* greyish-white, soft, pith large. *Annual rings* marked by a line. *Pores* moderate-sized to large, often subdivided, scanty. *Medullary rays* few, fine, short, making a marked silver-grain.

Nepal; hills of the Sikkim Himalaya up to 5000 ft.; Kachin hills of Burma.

The identification of the *Labshi* has long been in doubt, but has now been finally settled by the researches of Sir G. King and Dr. D. Prain. The wood has been used for tea-boxes, and the fruit is eaten by Nepalese and Lepcha hillmen.

		lbs.
E 4804.	Darjeeling Hills (Prain)	25

20. DRACONTOMELUM, Blume. *D. mangiferum*, Bl.; Fl. Br. Ind. ii. 43; Kurz For. Fl. i. 322, is a large evergreen tree found in the tropical and upper mixed forests of the Andaman Islands.

ORDER XXXIX. CORIARIEÆ.

1. CORIARIA, Linn.

C. myrtifolia, Linn., a shrub of South Europe (*Corroyère*, French), has leaves which are used for tanning and dyeing leather; its fruit is poisonous. *C. sarmentosa*, Forst, is a New Zealand shrub, the fruit of which is made into wine by the settlers.

1. **C. nepalensis**, Wall.; Fl. Br. Ind. ii. 44; Brandis For. Fl. 128. Vern. *Masúri, makola*, Hind.; *Litzaklo*, Sutlej; *Raselwa, archarru, pajerra*, Simla; *Bhojinsi*, Nep.; *Mosroi, gangeru, gangara*, Jaunsar; *Ayar*, Kumaon; *Gogsa makola*, Garhwal.

A deciduous straggling shrub or small tree. *Bark* reddish-brown, rough. *Wood* grey, hard, beautifully mottled; no heartwood. *Annual rings* distinct, marked by a belt of numerous moderate-sized pores; the *pores* of the outer portion of the annual rings are small and often joined by interrupted concentric bands of pale tissue. *Medullary rays* very broad, making, on a radial section, a conspicuous and handsome silver-grain.

Outer Himalaya from the Indus to Bhutan, ascending to 8000 ft. in the west, and to 11,000 ft. in Sikkim. It affects chiefly the outskirts of the forests.

Growth moderate, 5 to 6 rings per inch of radius. Weight 47 lbs. per cubic foot.

The wood takes a good polish, and is very handsomely marked, so it might be used for boxes and small articles. At present it is only used for firewood, and is often used as such about Simla. The wood contains a considerable amount of tannin.

The fruit is occasionally eaten, and the branches are said by Stewart to be browsed by sheep, but I do not remember ever to have noticed the fact, though I know the plant well. The name of the Hill Station, Mussoorie (properly, Masúri) is said to have been caused by the abundance of this plant on the site. It is one of the food-plants of the beautiful swallow-tail silk moth, *Actias Selene*, Hübn., but the silk is of poor quality.

			lbs.
H 68.	Mashobra, Simla,	7000 ft.	48
H 2853.	Mahasu, "	7500 ft. (Gamble)	53
H 2885.	Nagkanda, "	8000 ft. "	41

ORDER XL. MORINGEÆ.

1. MORINGA, Juss.

Wood soft, white. *Pores* large, scanty, usually in groups of two or three. *Medullary rays* short, moderately broad.

1. **M. pterygosperma**, Gaertn.; Fl. Br. Ind. ii. 45; Bedd. Fl. Sylv. t. 80; Brandis For. Fl. 129; Kurz For. Fl. i. 68; Talbot Bomb. List 64. *Hyperanthera Moringa*, Roxb. Fl. Ind. ii. 368. The Horse-radish tree. Vern. *Soanjna, sanjna, senjna, sejna, ganjna, soandal, sohajna, sainjan*, Hind.; *Sujuna*, Beng.; *Swanjera*, Sind; *Moonga*, Sonthal; *Mulgia*, Kól; *Sejana*, Monghyr; *Munigha*, Uriya; *Morunga*,

Tam.; *Saihan, sejan, munga, mulaka*, Tel.; *Nuggee, noogay*, Kan.; *Daintha, danthalôn*, Burm.

A tree. *Bark* 1 in. thick, grey, corky, with longitudinal cracks. *Wood* soft, white, spongy, perishable. Wood cells large, prominent. *Pores* large, scanty, often subdivided or in short radial lines of two or three. *Medullary rays* short, fine to moderately broad; the distance between them less than the transverse diameter of the pores, so that they bend when they pass the pores.

Wild in the sub-Himalayan tract from the Chenab to Oudh, very common in low forests near rivers in the Dún; commonly cultivated in India, Burma and Ceylon, about villages.

The tree is pretty; it is generally grown on account of its fruit, which is eaten as a vegetable and is pickled. The seeds are made into curry (drum-stick curry of Madras). The root has a strong flavour of horse-radish, and is used in medicine as a vesicant. It yields an oil similar to the *Ben oil* of watchmakers, which is not the produce of this, but of another species, *M. aptera*, Gaertn., of Africa. It also gives a reddish gum used in native medicine. The leaves and flowers are eaten as well as the fruit, and the branches are lopped for cattle-fodder. Camels are especially fond of them. Babu Upendranath Kanjilal tells me that the fruit of the wild trees is usually bitter, and not, therefore, edible, like that of the cultivated plant.

		lbs.
E 3214.	Calcutta (King)	—
O 4423.	Dehra Dún Forests (Grenfell)	19

2. M. concanensis, Nimmo; Fl. Br. Ind. ii. 45; Brandis For. Fl. 130; Talbot Bomb. List 64. Vern. *Sainjna*, Rajputana; *Soonjna, sainjna, segora, hegu, segu*, Merwara; *Mhúa*, Sind.

A tree. *Bark* thick, soft, corky. *Wood* white, soft. *Pores* large, often subdivided, enclosed in white rings, scanty. *Medullary rays* fine, numerous, the distance between them less than the diameter of the pores.

Rajputana, Sind, Konkan; the Deccan, especially in the Kurnool and Kistna Districts.

Wood apparently not used. The unripe fruit is eaten.

		lbs.
P 3226.	Nagpahar, Ajmere	—
D 4175.	Venkatayapalem Forest, Kistna (Gamble)	18

SERIES III. CALYCIFLORÆ.

ORDER XLI. CONNARACEÆ.

An Order of little importance, containing five genera of Indian trees, shrubs or climbing plants, chiefly occurring in Eastern Bengal, Burma, S. India and Ceylon.

Tribe I. Connareæ	Rourea, Connarus.
„ II. Cnestideæ	Cnestis, Tæniochlæna, Ellipanthus.

1. **ROUREA**, Aubl. Eight species, four of which only occur in Tenasserim, and are only climbing shrubs. Another is found in the Nicobar Islands, *R. humilis*, Bl. *R. santaloides*, W. and A.; Fl. Br. Ind. ii. 47; Bedd. Fl. Sylv. lxxxi.; Talbot Bomb. List 64; Trimen Fl. Ceyl. ii. 1; Vern. *Kirindi-wel*, Cingh., is a semi-scandent shrub or small tree of South India and Ceylon, used in the latter for making ropes for tying buffaloes and strengthening fences. *R. commutata*, Planch.; Fl. Br. Ind. ii. 47; Kurz For. Fl. i. 324 (*Cnestis monadelpha*, Roxb. Fl. Ind. ii. 454), is a similar plant of Eastern Bengal and Assam, Burma and the Andaman Islands. *R. caudata*, Planch., is also found in Assam and the Khasia Hills up to 4000 ft.

2. CONNARUS, Linn.

About eleven species, small trees or straggling shrubs, five of which are Burmese, four of South India or Ceylon, one of Eastern Bengal and one (*C. nicobaricus*, King), of the Nicobar Islands.

C. monocarpus, Linn.; Fl. Br. Ind. ii. 50; Bedd. Fl. Sylv. lxxxii.; Talbot Bomb. List 65; Trimen Fl. Ceyl. ii. 2; Vern. *Sundar*, Mar.; *Chettupulukodi*, Tam.; *Radaliya*, Cingh., is a much-branched shrub of the Western Gháts and coast, and of the low country of Ceylon. *C. Wightii*, Hook. f.; Fl. Br. Ind. ii. 51; Talbot Bomb. List 65, is a lofty climber, common in the moist evergreen forests of North Kanara. *C. Ritchiei*, Hook. f.; Fl. Br. Ind. ii. 51; Talbot Bomb. List 65, is a large climber found in the Konkan and on the Rám Ghát near Belgaum. *C. Championii*, Thw.; Fl. Br. Ind. ii. 52; Trimen Fl. Ceyl. ii. 3; Vern. *Wel-radaliya*, Cingh., is a climbing shrub of the moist region of Ceylon. *C. gibbosus*, Wall.; Fl. Br. Ind. ii. 52; Kurz For. Fl. i. 327, is a large half-scandent shrub of Chittagong, Burma and the Andamans up to 3000 ft. Four other species also occur in Burma, but are scarce and not of importance.

1. **C. paniculatus,** Roxb.; Fl. Ind. iii. 139; Fl. Br. Ind. ii. 52; Kurz For. Fl. i. 327. *C. pentandrus*, Roxb. Fl. Ind. iii. 140. Vern. *Múlseri*, Beng.; *Kadôk, kadet. taliti*, Burm.

A large climbing shrub. *Bark* yellowish-grey, ½ in. thick, rough, vertically fluted, furnished with many prominent lenticels. *Wood* light brown, soft, porous. *Pores* very large, very thick-walled. *Medullary rays* fine, obscure.

Khasia Hills and Sylhet up to 2000 ft.; Chittagong; Upper Burma.
Khasia Hills, 2000 ft.—Kew Museum (J. D. Hooker).

3. CNESTIS, Juss.

1. **C. ramiflora,** Griff.; Fl. Br. Ind. ii. 54; Kurz For. Fl. i. 329. *C. platantha*, Griff.; Kurz For. Fl. i. 328. Vern. *Tawkyetlauk, kyetmaukni*, Burm.

A small tree (or large scandent shrub). *Wood* reddish-brown, hard. *Pores* moderate-sized to large, scanty, in patches of soft tissue which are elongated concentrically into narrow interrupted belts. *Medullary rays* fine, very numerous, distinct in the hard dark tissue between the pale belts.

Tropical and low-lying forests throughout Burma; Andaman Islands.

The Fl. Br. Ind. puts together into one species the two described by Kurz (three described by Griffith), who makes the most common species, *C. platantha*, a climber, and says it has a soft white wood. The specimen described has a hard reddish wood with the structure of some Leguminosæ of the *Dalbergia* group, and more especially of the scandent species of the genus.

		lbs.
B 5095.	Shwègyin Division, Burma	52

2. **C. potatorum,** Watt MS. in Kew Museum.

A climbing shrub. *Bark* thick, dark brown, very rough. *Wood* greyish-white, in alternate rings of broad woody tissue with large or very large pores and moderate-sized medullary rays and narrow bast tissue, as in *Millettia auriculata*.

Manipur.

Watt says the Nagas use it to ferment rice spirit.

Manipur—Kew Museum (Watt, 1883).

4. TÆNIOCHLÆNA, Hook. f. *T. birmanica*, Prain in Journ. As. Soc. Beng. lxvii. ii. 285, is a shrub of the Kachin Hills.

5. ELLIPANTHUS, Hook. f.

Four species. *E. Thwaitesii*, Hook. f.; Fl. Br. Ind. ii. 55; Trimen Fl. Ceyl. ii. 3 (*E. unifoliatus*, Thw.; Bedd. Fl. Sylv. t. 170), is a tree of the moist region of Ceylon at 2–4000 ft. *E. calophyllus*, Kurz; Fl. Br. Ind. ii. 55; Kurz For. Fl. i. 329, is a small evergreen tree, common in the forests of the Andamans. *E. tomentosus*, Kurz; Fl. Br. Ind. ii. 56; Kurz For. Fl. i. 330, is a small evergreen tree of the tropical forests of the Pegu Yoma and Tenasserim; and *E. Helferi*, Hook. f., a small tree of Tenasserim or the Andaman Islands.

A specimen of the Malay *E. Griffithii*, Hook. f., sent by H. N. Ridley to the Kew Museum in 1900 has:—

Wood pinkish-grey, soft, with inconspicuous, very broken belts of loose dark tissue concentrically arranged. *Pores* small, very scanty, evenly distributed. *Medullary rays* fine, numerous, regular, giving a silver-grain of small elongated speckled plates.

ORDER XLII. LEGUMINOSÆ.

The largest of the Orders containing Indian Forest trees and shrubs, having no less than 74 indigenous genera of woody plants. It is divided into three Sub-Orders, viz.—

Sub-Order I. Papilionaceæ.
„ II. Cæsalpinieæ.
„ III. Mimoseæ.

The Order of the LEGUMINOSÆ is, taken all round, the most important Order in India to the Forester, whether it be in consequence of the great number of species or on account of the value of the timber and products given by them. With a few exceptions, like the Teak, the Sál and a few other Dipterocarps, the Deodar and some other Conifers, the trees of the Leguminosæ number among them the most valuable species, either sylviculturally or economically, that we possess. One has only to mention a few, such as the Sissoo, Khair, Pyingado, Padauk, Rosewood, Red Sanders, Anjan, Tamarind, Siris, Babúl to recognize this. Some other Orders besides those already mentioned, contain woods of considerable value, and among them are the MELIACEÆ, COMBRETACEÆ, URTICACEÆ, and Palms, but none of them have so many good kinds as the LEGUMINOSÆ. In Sylviculture, the number of gregarious species of value suitable for regular management makes the Order of importance; and among them are the Sissoo, Babúl, Khair, Anjan and Red Sanders; while it is the presence, in the forests in which they grow, of such species as Pyingado, Rosewood, Padauk, Bijasal and others that gives to those forests a value that without them they would hardly possess.

The general character of the woods of Leguminosæ is that of the *pores* (either singly, or in groups, or in irregularly concentric patches, or in fairly regular belts) being surrounded by loose tissue, that is, cellular tissue in which the cells are of larger size than they are in the rest of the wood. There are exceptions, such as *Hardwickia*, *Xylia*, some *Acacias*, *Albizzia* and *Acrocarpus*, but even these have a narrow pale ring. In all, the pores are usually scanty and generally rather large. The following is a tentative attempt at a grouping of the chief kinds.

A. OUGEINIA GROUP.

Pores enclosed in elongated patches of soft tissue, which are separate but arranged in more or less concentric lines. Instances of this group are *Ougeinia dalbergioides*, *Afzelia bijuga*, *Tamarindus indica*, *Acrocarpus*, *Xylia*.

B. ACACIA GROUP.

Pores enclosed in irregularly shaped patches of soft tissue, which are more or less

united in a reticulate pattern. *Prosopis spicigera, Cassia Fistula,* and *siamea,* and most species of *Acacia, Indigofera, Poinciana elata.*

C. Dalbergia Group.

Numerous, narrow, wavy, concentric bands of soft tissue, sometimes interrupted. Pores ringed, rather scanty, usually independent of the bands. *Dalbergia, Pterocarpus, Derris robusta, Dialium.*

D. Bauhinia Group.

Numerous, regularly distributed, concentric bands of soft tissue, which are broader than those in the *Dalbergia* group, and usually enclose the pores. *Pongamia, Bauhinia* (most species), *Cynometra.*

E. Hardwickia Group.

Pores isolated, not enclosed in patches of soft tissue, though they are generally surrounded by narrow rings. Concentric bands of soft tissue either wanting entirely, or very scanty. *Hardwickia, Adenanthera, Piptadenia, Mimosa, Acacia arabica, Dichrostachys, Bauhinia malabarica,* and *Cæsalpinia Sappan.*

F. Albizzia Group.

Pores isolated, generally large, not enclosed in patches of soft tissue, ringed, usually arranged in groups or oblique strings. None or very few concentric lines of soft tissue. *Albizzia, Acacia dealbata* and *Melanoxylon, Poinciana regia.*

G. Erythrina Group.

Pores large, scanty, unequal, irregular. Alternate bands of hard and soft tissue making, with the medullary rays, a tessellated pattern. *Erythrina, Butea* and *Millettia.*

Sub-Order I. PAPILIONACEÆ.

About 40 woody genera, some of which, however, contain only shrubs or climbers of comparatively little importance. They belong to 8 Tribes, viz.—

Tribe	I. Podalyrieæ	Piptanthus.
„	II. Genisteæ	Priotropis, Crotalaria.
„	III. Galegeæ	Indigofera, Colutea, Millettia, Mundulea, Tephrosia, Robinia, Sesbania, Caragana.
„	IV. Hedysareæ	Lespedeza, Alhagi, Æschynomene, Ormocarpum, Ougeinia, Desmodium.
„	V. Viceæ	Abrus.
„	VI. Phaseoleæ	Mucuna, Erythrina, Spatholobus, Butea, Mastersia, Dioclea, Pueraria, Atylosia, Cajanus, Cylista, Rhynchosia, Flemingia.
„	VII. Dalbergieæ	Dalbergia, Pterocarpus, Pongamia, Derris, Euchresta.
„	VIII. Sophoreæ	Dalhousiea, Sophora, Calpurnia, Pericopsis, Ormosia.

Ulex Europœus, Linn., the "furze" or "gorse," has been grown in the Himalaya and on the hills of S. India, and in the Nilgiris has now completely naturalized itself, some hill slopes near Ootacamund looking very English when the bright yellow flowers are out. Among other woody plants that have more or less fully acclimatized themselves on the Nilgiris, that home for plants from all the temperate and sub-temperate regions of the world, are *Psoralea pinnata,* Linn., a shrub with narrow leaflets and bright blue flowers, and *Virgilia capensis,* Lam., a shrub with silky foliage and pretty pink flowers, both from Cape Colony. *Cytisus Laburnum,* Linn., the Laburnum tree, is grown occasionally in the Himalaya. The broom, *Cytisus scoparius,* Link., is also frequently planted, and seems to have begun to run wild to some extent in the hills of Jaunsar.

Brya Ebenus, DC (Tribe "Hedysareæ") of the West Indies is the "Cocus wood," a hard dark wood used for tools, knife-handles, etc. It is of this wood that the staves used by London policemen are made (see specimens in Kew Museum, presented by Sir E. Bradford, Chief Commissioner). The "Cam wood" of trade is produced by *Baphia nitida*, Lodd., a tree of tropical Africa of the Tribe "Sophoreæ."

Wistaria chinensis, Sieb. and Zucc., has been found by Lieut. Pottinger in the Kachin Hills of Upper Burma; and a new genus, CRUDDASIA, Prain, with one species, *C. insignis*, Prain, has also been added from the same region.

The *wood* of the trees and shrubs of Sub-Order *Papilionaceæ* shows, on the whole, a wonderfully uniform structure, though the outward appearance and texture differ much. The great character is that the *pores* are comparatively scanty, that they are surrounded by pale patches consisting of much larger wood-cells than the rest of the wood shows, and that these patches are to a large extent confluent and indeed sometimes combined into more or less concentric bands of varying width, but always more or less wavy. The *medullary rays* are fine and regular, often very short. In *Erythrina* and *Butea* the bands become more prominent, but often discontinuous at the medullary rays, alternating with regular bands of more compact cellular structure, and the pores do not always come in the softer tissue. Some of the woods are very handsome and valuable, especially those of some species of *Dalbergia, Pterocarpus, Pericopsis, Ougeinia*. In *Erythrina, Butea, Pongamia* and some *Dalbergias* there is no heartwood.

TRIBE I. PODALYRIEÆ.

1. PIPTANTHUS, D. Don.

1. **P. nepalensis**, D. Don; Fl. Br. Ind. ii. 62; Brandis For. Fl. 132; Gamble Darj. List 25. Vern. *Bankaru*, Sutlej; *Shalgari*, Kumaon; *Chamba, chambóa*, Jaunsar.

A shrub. *Bark* greenish-grey. *Wood* white, with an irregular grey heartwood. *Pores* small, in wavy, oblique and concentric bands, except at the inner edges of the annual rings, which are marked by a continuous line of pores. *Medullary rays* fine, equidistant.

Himalaya from the Sutlej to Bhutan, above 7000 ft. in forest undergrowth; Khasia Hills, Manipur and Chin Hills in Burma.

A pretty shrub, with handsome, large, yellow flowers, which is sometimes planted for ornament in the hills and in Europe.

		lbs.
H 3024.	Nagkanda, Simla, 9000 ft. (Gamble)	40
E 3405.	Sandukpho, Darjeeling, 11,000 ft. (Gamble)	—

TRIBE II. GENISTEÆ.

2. PRIOTROPIS, W. and A.

1. **P. cytisoides**, W. and A.; Fl. Br. Ind. ii. 65; Kurz For. Fl. i. 363; Gamble Darj. List 25. Vern. *Takpyitmúk*, Lepcha.

An erect branching shrub. *Bark* smooth, yellowish. *Wood* white. *Pores* small, scanty, solitary or in radial lines between the fine *medullary rays*.

Eastern Himalaya at 3–6000 ft., common on old cultivated lands; hills of Upper Burma and Tenasserim.

E 3311. Pankabari, Darjeeling, 3000 ft. (Gamble).

3. CROTALARIA, Linn.

A large genus of mostly herbaceous plants, some of them, however, reaching the size of large shrubs. The chief home of the shrubby kinds is the Nilgiris, where the most prominent species are *C. semperflorens*, Vent. and *C. barbata*, Grah., of the higher sholas at 6–8000 ft.; *C. formosa*, Grah., of the grassy downs; and *C. fulva*, Roxb.; *C. obtecta*, Grah. and *C. Wightiana*, Grah., of the lower sholas and the slopes of the Ghâts. *C. tetragona*, Roxb. is a tall shrub of the Sikkim Terai and Lower Hills, extending west to the Saharanpur Siwaliks and eastwards to Assam and Burma (Vern. *Kengeni*, Nep.; *Suhutúng-rúng*, Lepcha). *C. Burhia*, Ham.: Brandis For. Fl. 144, is a shrub of the dry plains of Sind and Rajputana. *C. juncea*, Linn. is the "sunn"-hemp plant cultivated in many parts of India for its valuable fibre.

1. C. fulva, Roxb. Fl. Ind. iii. 266; Fl. Br. Ind. ii. 80.

A shrub. *Bark* thin, light brown. *Wood* yellowish, soft. *Pores* moderate-sized, scanty, in concentric bands rather far apart. *Medullary rays* fine, numerous.

Hills of the Deccan, Konkan, Mysore, Nilgiris.

D 3848. Nilgiri Hills, 5000 ft. (Gamble).

2. C. barbata, Grah.; Fl. Br. Ind. ii. 76.

A large shrub. *Bark* smooth. *Wood* yellowish-brown, moderately hard. *Pores* moderate-sized, in short radial lines or subdivided, arranged in concentric pale bands. *Medullary rays* fine, numerous.

Higher sholas of the Nilgiris at 6–8000 ft., extending south to Travancore.

	lbs.
W 4044. Doddabetta, Nilgiris, 7500 ft. (Gamble)	42

TRIBE III. GALEGEÆ.

4. INDIGOFERA, Linn.

A large genus containing mostly small undershrubs, a few only reaching a comparatively large size. *I. leptostachya*, DC; Fl. Br. Ind. ii. 100, is an erect shrub of Sikkim and the Khasia Hills at 5–8000 ft. *I. galegoides*, DC; Fl. Br. Ind. ii. 100; Kurz For. Fl. i. 360; Trimen Fl. Ceyl. ii. 28 (*I. uncinata*, Roxb. Fl. Ind. iii. 382); Vern. *Tawmèyaing*, Burm., is a shrub or small tree of the Khasia Hills, Burma and Ceylon. *I. atropurpurea*, Ham.; Fl. Br. Ind. ii. 101; Brandis For. Fl. 136, is a shrub of the hill forests of the Himalaya, from Hazara to Assam at 6–9000 ft. (Vern. *Bankati*, *kala sakena*, *sakna*, Hind.; *Khenti*, *jand*, Kaghan; *Kathi*, *gorkatti*, Kashmir). The chief "Indigo" plant is *I. tinctoria*, Linn.; Vern. *Níl*, Hind.; *Mènè*, Burm., extensively cultivated in India, but most so in the Districts of Behar.

1. I. heterantha, Wall.; Brandis For. Fl. 135. *I. Gerardiana*, Wall. (var.); Fl. Br. Ind. ii. 100. Vern. *Kathi*, *khenti*, *mattu*, *kats*, *shágali*, *lachata*, *kasting*, Pb.; *Kathi*, *theot*, Simla; *Kathoi*, Jaunsar; *Sakena*, Kumaon.

A shrub. *Bark* $\frac{1}{6}$ in. thick, smooth, dark grey, with longitudinal anastomozing lines. *Wood* hard, white, with an irregular heartwood of dark colour. *Annual rings* distinctly marked by a white line and by a continuous belt of pores. *Pores* small, scanty, enclosed in irregular white patches of soft texture, which frequently join, forming short, interrupted, concentric bands. *Medullary rays* fine, fairly numerous, almost equidistant.

North-West Himalaya and eastern skirts of the Suliman Range, ascending to 8000 ft.

Growth slow, 20 rings per inch of radius. Weight 55 lbs. per cubic foot. The

twigs are used for basket-work, and often form part of the twig bridges of the Western Himalaya. The shrub is gregarious on dry grassy slopes, and is very useful in preparing ground for Deodar planting, as it keeps the grass down and affords protection from the sun. The branches are very stiff and rather difficult to cut. When the shrub is in flower, the masses of pink on the hillsides look like heather in the distance.

		lbs.
H 2825.	Fagu, Simla, 8000 ft. (Gamble)	—
H 2870.	Nagkanda, Simla, 8000 ft. (Gamble)	—
H 2935.	Mahasu, Simla, 7000 ft. "	56
H 4404.	Mundali, Jaunsar, 8000 ft. "	—
H 4458.	Bodyar, Jaunsar, 8000 ft. "	54

2. **I. hebepetala**, Bth.; Fl. Br. Ind. ii. 101; Roxb. Fl. Ind. iii. 381. Vern. *Kathi, kathoi, dandeka katho,* Jaunsar.

A shrub of smaller size, but with wood of structure similar to that of *I. heterantha.*

Himalaya, from Kashmir to Sikkim, 6–15,000 ft.

The twigs are used for basket-work and twig bridges. This species prefers shady ravines in the upper forests. Flowers dark red.

H 2824. Cheog Forest, Simla, 7000 ft. (Gamble).

Note.—In Ed. 1, this specimen was described as *I. atropurpurea*, Ham., but all my Simla herbarium specimens appear to belong to *I. hebepetala*, Bth.

3. **I. pulchella**, Roxb. Fl. Ind. iii. 382; Fl. Br. Ind. ii. 101; Bedd. Fl. Sylv. lxxxv.; Brandis For. Fl. 136; Kurz For. Fl. i. 361; Gamble Darj. List 25. Vern. *Sakena, sakna, hakna,* Hind.; *Baroli,* Mar.; *Togri,* Bhil; *Balori,* Kurku; *Hikpi,* Lepcha; *Uterr,* Kól; *Tirhúl,* Kharwar; *Vréda,* Khond; *Chili,* Reddi; *Tawmèyaing,* Burm.

A large shrub. *Wood* with structure similar to that of *I. heterantha.*

Forests, almost throughout India, from the lower hills of the Punjab Himalaya eastwards and southwards; Eng and other dry forests in Burma.

A pretty shrub, with pretty red flowers, common in the deciduous forests, of Sál and Eng especially.

C 3447. Barasand Reserve, Palamow, Chota Nagpore (Gamble).

4. **I. stachyodes**, Ldl.; Gamble Darj. List 25. *I. Dosua*, Ham., var. *tomentosa*, Baker; Fl. Br. Ind. ii. 102. Vern. *Chiringi jhar,* Nep.

A small tree with thin brown *bark*. *Wood* hard, yellowish-brown, streaked. *Pores* small to moderate-sized, enclosed in patches of pale tissue, forming irregular, more or less concentric, bands. *Medullary rays* fine, numerous, equidistant.

Inner Eastern Himalaya, Khasia Hills, Sylhet, Shan Hills of Burma.

		lbs.
E 3359.	Rhenokh, Sikkim, 3000 ft. (Gamble)	51

5. COLUTEA, Linn. *C. nepalensis*, Sims.; Brandis For. Fl. 136 (*C. arborescens*, Linn., var. *nepalensis*; Fl. Br. Ind. ii. 103); Vern. *Bráa*, Ladak, is the "Bladder Senna," a shrub of arid valleys in the Himalaya, as far east as Sikkim, between 8000 and 11,500 ft. It is common about Simla, but I have never seen it in Jaunsar and Tehri-Garhwal.

Nordlinger's Section, vol. 5, *Colutea arborescens*, shows a white *wood*, well marked *annual rings;* scattered, rather scanty, often subdivided *pores*, moderately large in spring wood, smaller in autumn wood, and then in white patches somewhat concentrically arranged; and moderately broad *medullary rays*. The specimen is probably European (see Mathieu Fl. For. 124), but the plant is mentioned by Aitchison as a tall thin shrub, found in the Hariáb District, Kuram Valley.

6. MILLETTIA, W. and A.

This large genus contains about 27 species, about half of which are trees and the other half large climbing shrubs. Two species are South Indian, and the rest are all found in Eastern Bengal and Burma, but of these two species extend to India, the one (*M. auriculata*) being found in most of the dry forests, the other (*M. racemosa*) in the forests of the Eastern and Western Coasts.

Among the tree species, besides those specially described, *M. glaucescens*, Kurz; Fl. Br. Ind. ii. 107; Kurz For. Fl. i. 357 (*Derris microptera*, Gamble Darj. List 30); Vern. *Taungkazaw*, Burm., is a tree of the Sikkim Himalayan Terai and lower hills, and of the mixed forests and forests along streams in Burma, with a yellowish or light brown, hard but brittle, timber. *M. atropurpurea*, Bth.; Fl. Br. Ind. ii. 108; Kurz For. Fl. i. 358; Vern. *Tanyinni, kywèdanyin*, Burm., is an evergreen tree of the Burmese tropical forests giving a pale brown heavy wood and a red resin. *M. tetraptera*, Kurz; *M. pubinervis*, Kurz; and *M. ovalifolia*, Kurz, are less common trees of Lower Burma; while *M. multiflora*, Coll. and Hemsl.; *M. Wrightiana*, Prain; *M. macrostachya*, Coll. and Hemsl.; and *M. Dorwardi*, Coll. and Hemsl., are all trees of the Shan Hills of Upper Burma, three of them discovered by the late Col. Sir H. Collett, K.C.B., and described in *Journ. Linn. Soc.*, vol. xxviii. in 1890.

Among the climbing species, besides the two described, the most remarkable are: *M. splendens*, W. and A.; Fl. Br. Ind. ii. 104, a very handsome large species of the forests on the slopes of the Nilgiri and Anamalai Hills, the leaves and branches, flowers and fruit being covered with beautiful golden pubescence; *M. monticola*, Kurz; *M. Piscidia*, Wt.; *M. cinerea*, Bth. (Vern. *Maukap*, Lepcha); and *M. pachycarpa*, Kurz; Gamble Darj. List 26; Kurz For. Fl. i. 353, 354; Vern. *Kojulara*, Nep.; *Brúding*, Lepcha; climbers of the North-East Himalaya, extending through Assam and Eastern Bengal to Burma. *M. puerarioides*, Prain in Journ. As. Soc. Beng. lxvi. ii. 358 (*M. sericea*, Kurz For. Fl. i. 353), is a large woody climber found throughout Burma.

Wood usually in alternate bands or patches of firm and loose tissue. *Pores* scanty. *Medullary rays* fine, regular, numerous.

1. M. pulchra, Benth.; Fl. Br. Ind. ii. 104; Kurz For. Fl. i. 355. Vern. *Thitpagan*, Burm.

A tree. *Bark* brown, ¼ in. thick, nearly smooth. *Wood* light brown, hard, close-grained, with numerous regular, pale, wavy, concentric bands of loose tissue. *Pores* scanty, moderate-sized to large, often subdivided, ringed, single, or in small irregular groups, prominent on vertical sections. *Medullary rays* fine, regular, very numerous.

Assam; Khasia, Naga and Manipur Hills; Sylhet; Upper Burma; up to 4000 ft.

		lbs.
B 5111.	Burma	43

2. M. Brandisiana, Kurz; Fl. Br. Ind. ii. 108; Kurz For. Fl. i. 355. Vern. *Thitpagan*, Burm.

A deciduous tree. *Bark* brown, ¼ in. thick, wrinkled horizontally. *Wood* greyish-brown, soft, in alternate bands of firm and loose tissue, the bands wavy, often anastomozing and about equal in width, the loose bands dark and very prominent on vertical sections. *Pores* moderate-sized to large, very scanty, irregularly distributed in either kind of band. *Medullary rays* fine, regular, numerous.

Upper mixed forests of the Pegu Yoma in Burma.

The wood is probably useless, it is curiously like that of some species of *Ficus*, but has fewer pores.

		lbs.
B 5003.	Rangoon Division, Burma (C. Hodgson)	42
B 5112.	Burma	43

3. **M. pendula,** Bth.; Fl. Br. Ind. ii. 105. *M. leucantha,* Kurz For. Fl. i. 356. Vern. *Thinwin,* Burm.

A deciduous tree. *Wood* purplish-black, beautifully streaked, hard, with narrow concentric bands of soft tissue. *Pores* few, moderate-sized, in short radial strings. *Medullary rays* fine, uniform and equally distributed.

Savannah forests and dry lower hill forests of Burma up to 2000 ft.

Weight: Brandis' Burma List of 1862, No. 41, gives 60 lbs.; the specimen examined 66 lbs. per cubic foot. The wood is used for cross-pieces of harrows, and is worthy of attention for its beautiful grain and dark colour.

	lbs.
B 2520. Myodwin, Burma (Brandis, 1862)	66

4. **M. racemosa,** Benth.; Fl. Br. Ind. ii. 105; Talbot Bomb. List 68. *M. leiogyna,* Kurz; Fl. Br. Ind. ii. 109; Kurz For. Fl. i. 351. *Robinia racemosa,* Roxb. Fl. Ind. iii. 329. Vern. *Galuga,* Tel.

A large climber. *Bark* ¼ in. thick, brown, rough. *Wood* light brown, red in the centre, hard, with patches of loose tissue which anastomoze crosswise. *Pores* moderate-sized and large, scanty, surrounded by loose tissue. *Medullary rays* fine, white.

Deciduous forests of the Konkan and N. Kanara; forests of Behar, Orissa, the Northern Circars and S. Deccan as far as the Sandúr Hills of Bellary; Shan Hills of Upper Burma, Pegu and Tenasserim.

C 3839. Khond Gullery, Ganjam (Gamble).

5. **M. auriculata,** Baker; Fl. Br. Ind. ii. 108; Brandis For. Fl. 138; Gamble Darj. List 26. *M. extensa,* Bth.; Fl. Br. Ind. ii. 109; Kurz For. Fl. i. 352. *Robinia macrophylla,* Roxb. Fl. Ind. iii. 329. Vern. *Gauj,* Dehra Dún; *Maudh,* Oudh; *Gonjha, ganj,* Kumaon; *Salang,* Kashmir; *Hél,* Kól; *Hehel,* Sonthal; *Gurar,* Kharwar; *Gurúr,* Gondi; *Murari,* Kurku; *Rekorlo,* Uriya; *Kissi,* Khond; *Nedibunda,* Koya; *Gonjo,* Nep.; *Brú-rik,* Lepcha; *Damangè,* Burm.

A large climber. *Bark* thin, light brown with small rough lenticels. *Wood* white, in alternate layers of open tissue in broad bands or patches and of bast tissue in narrow bands which are more or less concentric at first and afterwards irregular. *Pores* large, conspicuously thick-walled, tubular, in the open tissue between the bast layers. *Medullary rays,* none apparent.

Sub-Himalayan tract and lower Himalaya from Kashmir to Bhutan, ascending to 3500 ft.; Parasnáth Hill in Behar, Singbhúm forests in Chota Nagpore; Northern Circars; deciduous forests of Burma.

One of the principal climbers of the Sál forests, exceedingly common in the North-Western Provinces, and regularly cut over in "cleanings." In open places, it is sometimes found as a small, almost erect, shrub, and is useful in helping to keep down the grass. The bark gives a rough fibre, as do the stems, which are beaten and made into rough cordage or into rough brushes. The leaves and twigs are lopped for cattle-fodder and elephant-forage.

Section in Dehra Dún Museum, no number.

B 2249 (73 lbs.) from the Andamans, and B 3141 (67 lbs.) from Myodwin, Burma (Brandis, 1862); Vern. *Chloani,* Burm., have a dark reddish-brown, very hard heart-wood, in structure resembling that of *M. pendula.* They appear to belong to some species of *Millettia.*

7. MUNDULEA, DC.

1. **M. suberosa,** Benth.; Fl. Br. Ind. ii. 110; Bedd. Fl. Sylv. lxxxv.; Talbot Bomb. List 68; Trimen Fl. Ceyl. ii. 29. *Robinia suberosa,* Roxb. Fl. Ind. iii. 327. *R. sennoides,* Roxb. Fl. Ind. iii. 328. Vern. *Neela murri,* Hyderabad; *Supti,* Bombay *Pil avaram,* Tam.

A small tree. *Bark* thick, corky, yellow. *Wood* yellow, rather darker in the heart, hard, close-grained, much resembling satinwood. *Pores* scanty, fine, joined by concentric lines of light tissue which sometimes anastomoze. *Medullary rays* fine, thin, clear, not numerous.

Rocky hills in the Southern Circars, Deccan and Carnatic; Konkan and South Mahratta country; abundant in the Ceded Districts and in Tinnevelly; dry region of Ceylon.

A pretty little tree, worthy of garden cultivation, and likely to be useful in reafforesting bare hills in such regions as Bellary.

D 4154. Piduguråla, Kistna (Gamble).
D 4170. Bollapalle, Kistna „

8. TEPHROSIA, Pers.

A genus containing several undershrubs, mostly weeds of roadsides and fallow lands, two only being of any size or importance.

1. T. candida, DC; Fl. Br. Ind. ii. 111; Brandis For. Fl. 138; Gamble Darj. List 26. *Robinia candida*, Roxb. Fl. Ind. iii. 327. Vern. *Lashtia*, Dehra Dún; *Lehtia*, Kumaon; *Bodle*, Nep.; *Suhutúngrúng*, Lepcha; *Balashoe*, Mechi.

A shrub. *Bark* thin, brown, with small rough lenticels. *Wood* white, with an irregular dark heartwood. *Pores* moderate-sized, often subdivided, enclosed in pale rings which spread out into patches of concentric arrangement. *Medullary rays* short, fine to very fine, numerous.

Undergrowth in the forests of the Himalayan lower hills and sub-Himalayan tracts from the Sutlej to Bhutan up to 3000 ft.; Assam, Khasia Hills and Burma.

A pretty shrub with cream-coloured flowers, often cultivated in gardens. The leaves and bark are used to poison fish.

O 4755. Dehra Dún, N.-W. Provinces (Gamble).
E 3636. Bamunpokri, Darjeeling (Gamble).

2. T. purpurea, Pers.; Fl. Br. Ind. ii. 112. *Galega purpurea*, Linn.; Roxb. Fl. Ind. iii. 386. *G. lanceæfolia*, Roxb. *l.c.* *G. tinctoria*, Roxb. *l.c.* Vern. *Kolinchi*, Tam.; *Pila*, Cingh.

A small shrub. *Bark* light brown, thin. *Wood* white, moderately hard. *Pores* moderate-sized, in concentric pale patches. *Medullary rays* fine, regular.

Throughout India and Ceylon, in the plains and hill valleys, a weed of roadsides and fallow lands.

C 3652. Daltonganj, Palamow (Gamble).

9. ROBINIA, Linn.

1. Robinia pseudo-acacia, Linn. The false Acacia, or Locust tree. *Robinier faux-acacia*, Fr.

A tree. *Bark* brown, rough, cleft longitudinally. *Wood* hard, sapwood white, heartwood yellowish- or reddish-brown, shining on a longitudinal section. *Pores* moderate-sized to large, often subdivided, larger in the spring wood and more continuous, making a well-marked annual ring, smaller and in scattered light patches in the autumn wood, the patches formed by larger cells than in the rest of the wood, and more or less concentrically arranged. *Medullary rays* fine, short, not deep, bent where they touch the pores, showing a good silver-grain.

A North American tree, indigenous in the United States from Pennsylvania to Georgia; cultivated largely in Europe, and of recent years in the Himalaya, especially about Simla.

As this tree has been so successfully grown in the Punjab Himalaya, and is likely to be still more grown in the future, it is introduced here and the wood described. The wood is much esteemed both in America and in Europe, and is used for various purposes. Hough gives the weight at 45·7 lbs. per cubic foot, Mathieu gives 41 to 48 lbs.

For an account of the best method of cultivating the tree in the Simla Hills, see "Ind. Forester," xxi. 168, by G. S. Hart. The most important point is that neither sowing nor planting should be done during the rains.

Nordlinger's Sections, vol. 1.

Hough's "American Woods," vol. iv. No. 80.

10. SESBANIA, Pers.

For a full account of the Indian species of *Sesbania*, see Prain in *Journ. As. Soc. Beng.* lxvi. ii. 366. *S. paludosa*, Prain; Vern. *Káthsola*, Beng., is a large annual plant of the swamps of Bengal, the pith of which is similar to "solah" pith, but harder.

1. S. ægyptiaca, Pers.; Fl. Br. Ind. ii. 114; Bedd. Fl. Sylv. lxxxvi.; Brandis For. Fl. 137; Kurz For. Fl. i. 362; Gamble Darj. List 26; Talbot Bomb. List 68; Trimen Fl. Ceyl. ii. 34. *Æschynomene Sesban*, Roxb. Fl. Ind. iii. 332. Vern. *Jait, jhijan, janjhan, dhandiáin*, Hind.; *Jayanti*, Beng.; *Saori, sewri*, Berar; *Shewari*, Mar.; *Chittakatti*, Tam.; *suiminta*, Tel.; *Yaythagyi*, Burm.

A short-lived, soft-wooded shrub. *Bark* brown. *Wood* white, extremely soft. *Pores* small, scanty, single or subdivided or in radial groups, between the very fine, and very numerous *medullary rays*, the distance between which is less than the transverse diameter of the pores.

Cultivated and run wild in many parts of India, also in Burma and Ceylon; wild in tropical Africa.

This shrub is chiefly grown as a hedge-plant, especially where very quick growth is required. In Berar and the Deccan it is grown for poles, also in places for pea-sticks and in some parts of India as a support to the betel-pepper vine. Roxburgh says the wood is used for gunpowder charcoal, and Prain confirms this as being the case to the present day. Kurz says that it is good for toys. The shrub is sometimes grown as a crop for cattle-fodder, and would be useful as a nurse in forest plantations. The bark gives a rope-fibre.

	lbs.
C 870. Amraoti, Berar (Drysdale).	27

Nordlinger's Sections, vol. 10.

2. S. grandiflora, Pers.; Fl. Br. Ind. ii. 115; Bedd. Fl. Sylv. lxxxvi.; Brandis For. Fl. 137; Kurz For. Fl. i. 362; Talbot Bomb. List 68; Trimen Fl. Ceyl. ii. 35. *Æschynomene grandiflora*, Roxb. Fl. Ind. iii. 330. Vern. *Basna*, Hind.; *Buka, bak, agasta*, Beng.; *Bagfal*, Sundarbans; *Akás*, Sonthal; *Hadga, heta*, Berar; *Augusta*, Mar.; *Agati, akatti*, Tam.; *Avesi*, Tel.; *Agase*, Kan.; *Paukpyu*, Burm.; *Katuru-murunga*, Cingh.

A short-lived, soft-wooded tree. *Bark* light brown, smooth. *Wood* white, soft. *Pores* small and moderate-sized, often in radial groups of 3 to 5 between the numerous, fine, white *medullary rays*.

Cultivated in Southern India, Burma, and in the Ganges Doab, indigenous in the Indian Archipelago and N. Australia.

This pretty little tree is noticeable for its large handsome pink flowers and long pods. The wood is not durable; in Lower Bengal it is used for posts for native houses and for firewood (Home); in Berar and the Deccan it is grown as a substitute for

bamboo. The tender leaves, pods and flowers are eaten as a vegetable, and the tree is grown as a support for the betel-pepper vine.

		lbs.
C 871.	Amraoti, Berar (Drysdale)	32

11. CARAGANA, Lam.

A genus of low spinescent shrubs of the arid region of the Punjab, Sind and Baluchistan, a few extending to the Western Himalaya. *C. pygmæa*, DC; Fl. Br. Ind. ii. 116; Brandis For. Fl. 134; Vern. *Dáma, táma, trama*, Ladak, is a small glabrous thorny shrub of the high arid regions of the Himalaya at 12–16,000 ft., extensively used for fuel and browzed by goats. Thomson mentions large areas near Hanle on the Upper Indus, where the shrub grows to 6 ft. high ("W. Him. and Tibet," p. 156). *C. decorticans*, Hemsl. in Hook. Ic. Plant. t. 1725, is a large spiny shrub of the Kurram Valley and Hazara, the bark of which is used by Afghans to bind the sheaths of their long knives, in which use it resembles leather.

1. **C. brevispina,** Royle; Fl. Br. Ind. ii. 116; Brandis For. Fl. 133. Vern. *Satbargi*, Thelam; *Drob, burkundu*, Kashmir; *Nyamzo*, Sutlej; *Ari,* Jaunsar.

A spinous shrub. *Bark* grey, peeling off in thin square flakes. *Wood* light yellowish-brown, with lighter patches, hard, close-grained. *Annual rings* marked by a belt of pores. *Pores* moderate-sized, partly in the rings, partly in pale patches. *Medullary rays* fine, scanty, prominent.

Higher forests of the Western Himalaya from the Indus to the Ganges at 5–9000 ft., in undergrowth of fir and oak forests or in open glades on dry ridges.

H 4461. Mundali, Jaunsar, 8000 ft. (Gamble).

2. **C. ambigua,** Stocks; Brandis For. Fl. 134. Vern. *Shinaluk*, Baluch; *Jirral*, Kuram Valley.

A shrub. *Bark* rough, grey, longitudinally cleft. *Wood* yellowish with a red streaked heartwood, hard. *Annual rings* marked by lines of moderate-sized pores, the *pores* in the rest of the wood very scanty, small, in somewhat concentric but oblique white patches. *Medullary rays* fine, scanty.

Hills of Baluchistan, up to 8000 ft.

P 4475. Baluchistan (Lace).

3. **C. Gerardiana,** Royle; Fl. Br. Ind. ii. 116; Brandis For. Fl. 133.

A shrub. *Bark* and *wood* exactly similar to those of *C. ambigua*.

Baluchistan, extending northwards to the Himalaya and then eastwards to Kumaon, from 7–12,000 ft.

		lbs.
P 4476.	Baluchistan (Lace)	61

Tribe IV. HEDYSAREÆ.

12. LESPEDEZA, Mich.

Mostly small undershrubs, four species only reaching any size. *L. stenocarpa*, Maxim.; Prain in Journ. As. Soc. Beng. lxvi. ii. 376, is a shrub with pretty flowers growing on rocks in the Western Himalaya at low elevations, common in the Saharanpur Siwaliks. *L. Prainii*, Coll. and Hemsl. in Journ. Linn. Soc. xxviii. 46, and *L. sericophylla*, Coll. and Hemsl. *l.c.* 45, are large shrubs of the Shan Hills at 4–5000 ft., the former very conspicuous on account of its large terminal panicles of blue flowers.

1. **L. eriocarpa,** DC; Fl. Br. Ind. ii. 144.

An erect shrub. *Bark* brown. *Wood* hard, sapwood yellowish,

heartwood red. *Annual rings* marked by a continuous white line of small pores, elsewhere *pores* small, surrounded by white rings, single or in more or less concentric and oblique patches. *Medullary rays* fine, rather scanty.

Throughout the higher Himalaya from Kashmir to Sikkim at 3-9000 ft. A pretty shrub with handsome purple flowers.

		lbs.
H 3192.	Nowti Valley, Simla, 4000 ft. (Gamble)	—
H 4639.	Tons Valley, Tehri-Garhwal, 4000 ft. (Gamble)	60

13. ALHAGI, Desv. *A. camelorum*, Fisch.; Prain in Journ. As. Soc. Beng. lxvi. ii. 377 (*A. maurorum*, Bak.; Fl. Br. Ind. ii. 145; Brandis For. Fl. 144; Talbot Bomb. List 68); Vern. *Jawása, jowassi, jawá, jawani*, Punjab; *Kas*, Sind, is the Camelthorn, a small thorny shrub of dry barren places in the plains of Upper India, extending down the Ganges Valley to Monghyr, and through Western India to the S. Mahratta country.

14. ÆSCHYNOMENE, Linn. *Æ. aspera*, Linn.; Fl. Br. Ind. ii. 152; Brandis For. Fl. 147; Trimen Fl. Ceyl. ii. 39 (*Hedysarum lagenarium*, Roxb. Fl. Ind. iii. 365); Vern. *Sola, phúl-sola*, Hind.; *Nirjilúza*, Tel.; *Attuneddi*, Tam., is the "Solah" plant of tanks and marshes from whose stems the well-known white pith is chiefly obtained which is used in making hats, toys, fishing-floats, etc. Very closely allied to this genus is *Herminiera Elaphroxylon*, Guill. et Perr., so very common on the Upper Nile, whence specimens have recently been received from Mr. E. Muriel. The trunk is thick; *bark* exceedingly thin, smooth except for lenticels and spirally arranged striæ. *Wood* simply a mass of soft pith like that of "Solah," for which it should prove a cheap and easily obtained substitute, for the plant is exceedingly common in the "sudd" region.

15. ORMOCARPUM, Beauv. *O. Sennoides*, DC; Fl. Br. Ind. ii. 152; Kurz For. Fl. i. 390; Trimen Fl. Ceyl. ii. 39 (*Hedysarum sennoides*, Willd.; Roxb. Fl. Ind. iii. 364), is an evergreen shrub of Central and South India and Ceylon.

16. OUGEINIA, Bth.

1. **O. dalbergioides**, Benth.; Fl. Br. Ind. ii. 161; Bedd. Fl. Sylv. t. 36; Brandis For. Fl. 146, t. 23; Gamble Darj. List 26; Talbot Bomb. List 69. *Dalbergia Oojeinensis*, Roxb. Fl. Ind. iii. 220. Vern. *Sandan, asainda, tinnas, timsa*, Hind.; *Shánjan, pánan*, Oudh; *Sandan pipli*, Nep.; *Bandhona*, Uriya; *Kala palás, tewas*, Mar.; *Tewas, ruthu*, Melghát; *Panan*, Monghyr; *Ruta*, Kól; *Rót*, Sonthal; *Pannan*, Koderma; *Jaru*, Khond; *Eru*, Koya; *Chichera*, Reddi; *Sér, shermanu, tinsai*, Gondi; *Dargu, tella motku*, Tel.; *Kari mutal*, Kan.; *Tewsa*, Bhíl; *Rutok, ruthu*, Kurku; *Tunnia*, Banswara; *Telus*, Khandésh.

A moderate-sized deciduous tree, sometimes gregarious. *Bark* $\frac{1}{8}$ in. thick, light brown, sometimes with bluish patches, with regular longitudinal and horizontal cracks. *Wood* hard, close-grained: sapwood small, grey; heartwood mottled, light brown, sometimes reddish-brown. *Annual rings* indistinct. *Pores* moderate-sized, enclosed in irregularly shaped, more or less concentric but interrupted patches and bands of white soft tissue, which is really tissue of larger cells than in the rest of the wood. *Medullary rays* fine, numerous, white, uniform and equidistant, distinctly visible in the hard tissue between the soft patches. Pores marked on a longitudinal section, which also is characterized by very regular faint cross-bars.

Northern and Central India. Lower Himalaya from the Jhelum to Bhutan, ascending to 5000 ft., and very common in hot valleys and in forests of *Pinus longifolia*; scarce east of Nepal; sub-Himalayan tracts of the Punjab, North-Western Provinces and Oudh; Central India, Behar, Chota Nagpore, Orissa and the Circars down to the Godavari; throughout the Bombay Presidency down to N. Kanara, where it is common and of large size; occasional in the South Deccan, Mysore and the northern slopes of the Nilgiris.

This very pretty and useful tree is a valuable one in India; it comes up readily in blanks in the forests and on hilly slopes, landslips and bare places, as in the Siwaliks; it is common in Sál forests, and frequent in those of long-leaved pine, but in such accompaniments rarely of large size; in the forests of Orissa, the Circars, Konkan and Kanara it grows into a large tree. The wood is much in request for agricultural implements, such as ploughs; and, being tough and strong, is useful for carriage-building. It makes excellent furniture. Roxburgh mentions that the pillars of Maharaja Sindhia's palace at Oojein are made of it. Brandis gives the weight at 57 to 60 lbs.; Talbot's experiments, with six pieces of Bombay wood, in 1885, with scantlings 6′ × 2″ × 2″ and 7′ × 2″ × 2″, gave an average result of W = 52 lbs., P = 835; the specimens examined give an average weight of 55 lbs., which may be accepted as mean. The bark is pounded and used to intoxicate fish; it gives a rough coarse fibre and a red transparent astringent gum from incisions. A white crystalline substance, apparently magnesia, is sometimes found in the wood. The branches are much lopped for fodder for cattle.

The natural reproduction of Sandan is excellent, and it is very easily propagated artificially. It can be grown from root-suckers. It is often grown for ornament in gardens, and when in full flower and covered with its purple inflorescences, it is very pretty.

			lbs.
P	102.	Sutlej Valley, Punjab	—
O	212.	Garhwal (1868)	52
C	3477.	Saranda Forests, Chota Nagpore (Gamble)	56
C	3681.	Palamow Forests „ „ „	56
C	185.	Mandla, Central Provinces (1870)	53
C	1152.	Ahiri Reserve, Central Provinces (R. Thompson)	54
C	2767.	Melghát, Berar (Brandis)	55
C	1242.	Gumsúr, Madras (Dampier)	52
E	601.	Lohagarhi, Darjeeling Terai (Manson)	67
W	1226.	North Kanara (Barrett)	53
W	4077.	Moyar Forests, Nilgiris, 3000 ft.	56

Nordlinger's Sections, vol. 9, also vol. 8 (*Dalbergia ougeinioides*, Roxb.).

17. DESMODIUM, Desv.

A large genus of shrubs or undershrubs, with pretty flowers and jointed pods, many of them being conspicuous plants in the Indian forests. Few, however, reach any size, and only one is of any particular forest importance. *D. gyrans*, DC; Fl. Br. Ind. ii. 174; Brandis For. Fl. 146; Talbot Bomb. List 70; Trimen Fl. Ceyl. ii. 56 (*Hedysarum gyrans*, Roxb. Fl. Ind. iii. 351); Vern. *Gorachand*, Beng.; *Bolú*, Nep.; *Chauchala*, Cingh., is a small erect single-stemmed shrub, common in grass lands, Sál forests and forests of long-leaved pine in N. India, and generally in similar places in S. India and Ceylon, with small sensitive rotating lateral leaflets, which cause it to be known as the "Telegraph plant" or "Semaphore plant." *D. gyroides*, DC; Fl. Br. Ind. ii. 175; Kurz For. Fl. i. 388; Gamble Darj. List 27; Trimen Fl. Ceyl. ii. 56; Vern. *Bolú*, Nep., is a large shrub of the E. Himalaya, Eastern Bengal, Burma and Ceylon, with purple flowers and a "pale greyish-brown, heavy, close-grained wood" (Kurz).

1. D. umbellatum, DC; Fl. Br. Ind. ii. 161; Bedd. Fl. Sylv. lxxxvii.; Kurz For. Fl. i. 385; Talbot Bomb. List 69; Trimen Fl. Ceyl. ii. 47.

A shrub. *Bark* thin, light brown. *Wood* white, hard. *Pores* moderate-sized, very scanty. *Medullary rays* fine, very numerous. Concentric wavy rings of white tissue, close and regular, but often anastomozing.

Coasts of India, Burma and Ceylon, in sandy beach jungles.

D 3998. Madras (cult.)—var. *hirsuta*, DC.

***2. D. Cephalotes,** Wall.; Fl. Br. Ind. ii. 161; Bedd. Fl. Sylv. lxxxvii.; Kurz For. Fl. i. 386; Gamble Darj. List 26; Talbot Bomb. List 69; Trimen Fl. Ceyl. ii. 47; *Hedysarum Cephalotes*, Roxb. Fl. Ind. iii. 360. Vern. *Bodle kúrú*, Nep.; *Maniphiyol*, Lepcha; *Chetenda*, Tel.

A shrub, often gregarious. *Bark* grey. *Wood* yellowish, in structure resembling that of *D. tiliæfolium.* Stems triquetrous.

Eastern Himalaya from Nepal to Assam, thence to Chittagong; common in dry mixed forests in Burma, also in savannahs and north to the Kachin Hills; frequent in Teak forests in S. India, often becoming a small tree with trunk up to 10 in. diam. (Bedd.); low country of Ceylon.

E 3281. Dainah Forest, W. Dúars, Bengal (Gamble).

3. D. pulchellum, Benth.; Fl. Br. Ind. ii. 162; Brandis For. Fl. 145; Gamble Darj. List 26; Talbot Bomb. List 69; Trimen Fl. Ceyl. ii. 48. *Hedysarum pulchellum,* Linn.; Roxb. Fl. Ind. iii. 361. Vern. *Juta salpani,* Beng.; *Set krishnapani,* Cuttack; *Taungdamin,* Burm.; *Hampilla,* Cingh.

An erect, often gregarious, shrub, the flowers in bifoliate round bracts. *Wood* hard, yellowish-white. *Annual rings* marked by a white line. *Pores* small. *Medullary rays* fine, white.

Throughout India from Dehra Dún eastwards and southwards in damp places; deciduous forests of Burma; low country of Ceylon.

C 3432. Amjheria, Lohardugga, Chota Nagpore (Gamble).

4. D. confertum, DC.; Fl. Br. Ind. ii. 167; Gamble Darj. List 26. Vern. *Chiptikúrú,* Nep.

A shrub. *Bark* dark olive-green. *Wood* dark grey, hard. *Pores* moderate-sized, scanty, often subdivided, evenly distributed, a continuous belt forming the annual ring. *Medullary rays* fine, numerous, the distance between them equal to the diameter of the pores. No concentric lines as in *D. tiliæfolium.*

Central and Eastern Himalaya, Khasia Hills up to 4000 ft.

E 3724. Kalimpúng, Darjeeling, 4000 ft. (Gamble).

5. D. tiliæfolium, G. Don; Fl. Br. Ind. ii. 168; Brandis For. Fl. 145. Vern. *Sambar, shamru, chamra, chamyúr, chamkat, chamkúl, martan, motha, múti, gurshagal, pri, marára, múss, múrt, laber,* Hind.; *Martoi,* Jaunsar; *Chamlia, bhatula,* Kumaon; *Chamlái,* Garhwal; *Bhatia,* Dotial.

A large deciduous shrub. *Bark* thin, grey. *Wood* yellowish-brown, with a darker centre. *Pores* small. *Annual rings* distinctly marked by a belt of small pores; in the outer part of each annual ring the pores are very small, and generally arranged in short, linear, wavy, concentric lines. *Medullary rays* white, fine to very fine.

Sulaiman Range from the Kurram Valley to the Indus; Himalaya, eastwards to Nepal and Sikkim, where very scarce, at 3–9000 ft.; Kachin Hills of Upper Burma.

This pretty shrub grows to a large size in the Himalaya, chiefly on dry grassy slopes and in glades in the deodar forests, where it is regularly associated with *Indigofera heterantha,* and, like that species, serves to keep down grass and assist the reproduction of deodar and blue pine. The wood is a good fuel, and the branches are used for fodder. The fibrous bark is used for rope and paper making, the latter in the Buddhist monasteries. Growth slow, 14 rings per inch of radius. Flowers pink or lilac, appearing in June, fruit in October.

		lbs.
H 3184.	Dungagalli, Hazara, 8000 ft.	—
H 51.	Nagkanda, Simla, 7000 ft. (Gamble)	—
H 2934.	Mahasu, Simla, 7000 ft. (Gamble)	53
H 3019.	Kotgarh, Simla, 7000 ft. (Gamble), (var. *argentea,* Wall.)	—

TRIBE V. VICIEÆ.

18. ABRUS, Linn. Three species of small wiry climbers, among which the most noticeable is *A. precatorius*, Linn.; Fl. Br. Ind. ii. 175; Roxb. Fl. Ind. iii. 258; Brandis For. Fl. 139; Talbot Bomb. List 70; Gamble Darj. List 27; Trimen Fl. Ceyl. ii. 57; Vern. *Gunchi, rakti*, Hind.; *Ratu*, Berar; *Maspati*, Nep.; *Mik-kukrik*, Lepcha; *Chirmi*, Merwara; *Karzani*, Monghyr; *Kaincho*, Uriya; *Kuntumani*, Tam.; *Ywengè*, Burm.; *Olindawel*, Cingh. This plant is noticeable on account of its round seeds, (*rati, rakti*), which are red with a black eye, or sometimes white or black and white, and are used by jewellers as weights. They weigh about 1⅞ grains each, and are also used to make necklaces, earrings, and to ornament boxes and weapons. The plant is also used medicinally. It is chiefly found on open lands, climbing over bushes and hedges, and the open pods showing the scarlet and black seeds are very conspicuous and ornamental.

TRIBE VI. PHASEOLEÆ.

19. MUCUNA, Adans.

Climbing shrubs, some of them very large, and several of them with rigid bristles on the pods, which bristles easily come off and penetrate the skin, causing an intolerable itching. *M. imbricata*, DC; Fl. Br. Ind. ii. 185; Vern. *Kasi*, Beng., is a large climber of Bengal and Assam with a big broad 2–4 seeded pod plaited on the faces and furnished with bristles. *M. monosperma*, DC is a similar species chiefly of Western and Southern India and Ceylon, with similar bristles, but a one-seeded pod. *M. atropurpurea*, DC; Fl. Br. Ind. ii. 186; Vern. *Bhainswali bel*, Dehra Dún, is a similar species, found more or less over India and Ceylon, and very common in the Dehra Dún ravines, with somewhat similar but 2-seeded fruit. *M. gigantea*, DC is a species which inhabits the coast regions of India and Burma, Ceylon and the Andamans, and has a pod with wings on both edges and irritating bristles. *M. pruriens*, DC; Fl. Br. Ind. ii. 187; Vern. *Alkusá*, Beng.; *Kiwách, goncha*, Hind.; *Kouatch*, Nep.; *Kwele*, Burm., is the "Cowhage" or "Cow-itch" climber, very common in most damp places and ravines, also in hedges throughout India, and bearing a rather small cylindrical pod covered with irritating golden-coloured bristles, which are used as a vermifuge. It is scarcely a woody plant, but requires to be mentioned, chiefly as one to be avoided where possible.

1. **M. macrocarpa**, Wall.; Fl. Br. Ind. i. 186; Kurz For. Fl. ii. 379; Gamble Darj. List 27. Vern. *Balengra*, Nep.; *Tanyerik*, Lepcha.

An enormous climbing shrub. *Bark* soft, greyish-black. *Wood* soft, fibrous, greyish-black when dry. It is composed of concentric rings, the inner part of which is a black pore-less tissue having tongues radiating outwards into the outer tissue, which has large and very large, often subdivided *pores*.

Eastern Himalaya from Nepal eastwards, Khasia Hills and Sylhet up to 7000 ft.; Kachin Hills and Shan Hills plateau in Upper Burma at 4000 ft.; pine forests on the Bookee ridge in Pegu at 4–6000 ft.

This is the largest climber of the Upper Darjeeling forests; it bears its yellowish-white flowers chiefly on the stem, and has pods of 1 to 1½ ft. long, twisted. Haines, quoted by Manson in the Darjeeling Working Plan, 1893, says it is the climber most difficult to get rid of, and that it sends its branches over several trees, binding them together, and being exceedingly common in the poorer parts of the forest, it damages saplings and prevents reproduction.

E 3575. Darjeeling Forests, 7000 ft. (Gamble).

20. ERYTHRINA, Linn.

Seven species, one of which, *E. resupinata*, Roxb. Fl. Ind. iii. 257; Fl. Br. Ind. ii. 189; Brandis For. Fl. 141, is a small herbaceous species with an underground woody rootstock, found in grass lands in the sub-Himalayan forests of the North-Western

Provinces and Oudh, also on Parasnáth in Behar. It is one of the curious dwarf representatives of otherwise tree-producing genera (see also *Ochna*, *Grewia*, *Combretum*, *Careya*, *Premna*) which seem to have become definite species through years of regular burning of the above-ground stems. It is very conspicuous when in flower with its large bright scarlet racemes, which appear first, followed by a short leaf-bearing stem, which dies down after the south-west monsoon rains. The structure of the wood of the rootstock is that of the tree *Erythrinas*.

The rest of the Indian species are soft-wooded, handsome-flowered, deciduous trees, the most common and most important of which is *E. suberosa*, Roxb. *E. ovalifolia*, Roxb. Fl. Ind. iii. 254; Fl. Br. Ind. ii. 189; Bedd. Fl. Sylv. lxxxviii.; Kurz For. Fl. i. 367; Trimen Fl. Ceyl. ii. 64; Vern. *Huri-kekra*, Beng.; *Kônkathit*, Burm., is a prickly stemmed tree of the coast forests of Chittagong, Arracan and Pegu, extending northwards to Sylhet and Assam.

Wood white, very soft, no heartwood. *Pores* large to very large, very scanty, often subdivided, thick-walled, septate. *Medullary rays* broad, joined by concentric but interrupted irregular narrow bars, so that the wood has a reticulate appearance. In these cross-bars the wood cells are smaller and the texture is denser. In the spaces between them the cellular tissue is very open, the cells usually pentagonal.

1. **E. suberosa**, Roxb. Fl. Ind. iii. 253; Fl. Br. Ind. ii. 189; Bedd. Fl. Sylv. lxxxvii.; Brandis For. Fl. 140; Kurz For. Fl. i. 369; Gamble Darj. List 27; Talbot Bomb. List 71. Vern. *Pangra*, *panjira*, *dauldhák*, *rúngra*, *rowanra*, *nasút*, *madára*, Hind.; *Gúlnashtar*, *pariára*, *thab*, Pb.; *Gadichora*, Merwara; *Nangthada*, Berar; *Fullidha*, Nep.; *Mandat*, Gáro; *Katiang*, Lepcha; *Muni*, *maduga*, Tam.; *Mulu modugu*, Tel.; *Phangera*, Gondi; *Gada phassa*, Kurku; *Farhud*, Kharwar; *Paldua*, *chaldua*, Uriya; *Muskamba*, Khond; *Kathit*, Burm.

A moderate-sized deciduous tree. Outer *bark* corky, light grey, with deep, irregular, vertical cracks, varying in thickness up to 1 in.; inner bark fibrous, ⅓ inch thick. *Wood* very soft, spongy, white, fibrous but tough; that near the centre of darker colour, but not a regular heartwood. *Pores* very large, very scanty, often subdivided, conspicuous on a vertical section and markedly septate. *Medullary rays* short, broad; the tissue between the rays reticulated by irregular more or less concentric interrupted narrow bands of firm texture like the medullary rays, separating rectangular patches of white, spongy tissue. On the radial section the medullary rays appear as broad shining bands, giving the wood a marked silver-grain, and the pores are prominent, while the alternate bands of hard and soft tissue appear as alternate longitudinal streaks.

Dry forests throughout India and Burma; Lower Himalaya and sub-Himalayan forests from the Ravi to Nepal, ascending to 3000 ft.; common in the Sál and mixed forests of the Dún, Oudh and intermediate country; common also in Behar, the C.P., Chota Nagpore, Orissa, the Circars and Deccan, getting scarcer southwards; Shan Hills of Upper Burma and mixed forests of the Pegu Yoma.

The wood of this tree, though so light and soft, is fairly durable, and is in considerable demand for various purposes, such as scabbards, sieve-frames, planking, and especially for jars for household purposes, and boxes to be covered with lacquer, so that in such forests as those of the Dehra Dún, the purchasers of the yearly coupes are glad to get it and to utilize it separately. The tree grows readily from cuttings, is very quick growing (4 rings per inch) and ornamental. The average weight of the wood is about 19 lbs. per cubic foot.

			lbs.
O	530.	Dehra Dún (O'Callaghan)	20
O	4490.	Lachiwála, Dehra Dún (Gradon)	20
C	1145.	Ahiri Forest, C.P. (R. Thompson)	—
C	820.	Bairagarh Forest, Berar (Drysdale)	17

2. **E. indica**, Lam.; Fl. Br. Ind. ii. 188; Roxb. Fl. Ind. iii. 249; Bedd. Fl. Sylv. lxxxvii.; Brandis For. Fl. 139; Kurz For. Fl. i. 368; Talbot Bomb. List 71; Trimen Fl. Ceyl. ii. 63. The Indian Coral tree. Vern. *Pangra, panjira, pangara, farad,* Hind.; *Palita mandar,* Beng.; *Muruká,* Tam.; *Modugu, badapu, badidapu,* Tel.; *Pangara, phandra,* Mar.; *Háliwára, páliwára,* Kan.; *Chaldua, paldua,* Uriya; *Madar,* Cachar; *Katheik,* Magh; *Inkathit, pinlèkathit,* Burm.; *Erabadu,* Cingh. (*Mochi* wood of Madras.)

A deciduous tree. *Bark* yellowish, smooth and shining, peeling off in thin papery flakes, young stems and branchlets armed with prickles. Structure the same as that of *E. suberosa.*

Coast forests of the Bay of Bengal from the Sundarbans, through Arracan and Pegu to Tenasserim; coast of Malabar and Ceylon; Andaman and Nicobar Islands; much planted.

Since the first edition of this work was written, Dr. Prain has pointed out that this is, in its wild state, only a coast plant, and that inland it is only found as a cultivated tree, so that I am a little in doubt about the vernacular names. Brandis ("Ind. For." xxv. 395) considers it to be also sometimes wild inland, especially in the Bombay forests. The wood is used for the same purposes as that of *E. suberosa.* The tree is cultivated as a support to the betel-pepper vine, and as an ornamental garden or park plant. It gives a dark brown gum of no value.

		lbs.
B 2343.	Myanaung, Burma (Gamble)	18
B 2223.	Andaman Islands (Col. Ford, 1866)	26

3. **E. stricta**, Roxb. Fl. Ind. iii. 251; Fl. Br. Ind. ii. 189; Bedd. Fl. Sylv. t. 175; Kurz For. Fl. i. 369; Talbot Bomb. List 72; *E. indica,* Lam.; Gamble Darj. List 27, *in part.* Vern. *Fullidha,* Nep.; *Katiang,* Lepcha; *Murukku,* Tam., Mal.; *Mouricou, kichige,* Kan.; *Taungkathit,* Burm.

A large or small deciduous tree. *Bark* armed with white prickles. *Wood* structure the same as that of *E. suberosa.*

Assam, Eastern Bengal, Manipur, extending westwards to Nepal, and perhaps further (Prain mentions Wallichian specimens coming from Kumaon and even Hardwar); common on the western coast in the Konkan and N. Kanara and down to Travancore; upper mixed forests of the Pegu Yoma and Prome in Burma.

Its uses and character are the same as for *E. suberosa* and *indica.*

		lbs.
E 2344.	Bamunpokri, Darjeeling Terai (Gamble)	16

4. **E. arborescens**, Roxb. Fl. Ind. iii. 256; Brandis For. Fl. 140; Gamble Darj. List 27. Vern. *Rungara, mandiáru,* Kumaon; *Rodinga, fullidha,* Nep.; *Gyesa,* Lepcha; *Dingsong,* Khasia.

Wood structure similar to that of *E. suberosa,* but it is more compact, less spongy, and has more numerous concentric bands.

Outer Himalaya from the Ganges to Bhutan, up to 7000 ft.; Khasia Hills.

This handsome tree is often planted for ornament, as in the avenues at Darjeeling. The flowers are scarlet and appear contemporaneously with the leaves, so that the tree is even handsomer than the other species. It is easily grown from cuttings.

E 3106, 3330. Darjeeling, 7000 ft. (Gamble).

5. **E. lithosperma**, Bl.; Fl. Br. Ind. ii. 190; Kurz For. Fl. ii. 367. Vern. *Yekathit,* Burm.

A moderate-sized tree with prickly stem. *Wood* greyish-white, soft, the structure similar to that of *E. suberosa.*

Upper mixed forests of Pegu and Martaban, along streams; Shan Hills.

This tree is universally employed in the Java plantations as a shade tree for coffee, and, with *E. umbrosa,* H. B. K. from Central America and *E. velutina,* Willd. from the W. Indies, is used for the same purpose over cocoa in Ceylon. The Java name is "*Dadap,*" and Mons. Jean Massart (*Un botaniste en Malaisie*—Gand, 1895) says that

its chief advantage lies in its having root-knots which are caused by fungi, and which enrich the soil with nitrogen, while also it is very easily grown from cuttings.

B 5025. Tharrawaddy Division, Burma.

21. SPATHOLOBUS, Hassk.

As now described by Dr. Prain (*Journ. As. Soc. Beng.* lxvi. ii. 412, and lxvii. ii. 2, 286) there are about ten species of this genus in India and Burma. *S. purpureus*, Bth.; Talbot Bomb. List 71, is a large climber of the Supa Ghát forests in North Kanara. *S. crassifolius*, Bth. is found in the Khasia Hills and Sylhet; and *S. Listeri*, Prain, in those of Chittagong. The rest, except that described below, are all Burmese, one of them, *S. riparius*, Prain, being described as a "low-spreading tree hanging over 'streams" on Taepo, 5000 ft., in Tenasserim, and at Taungkyaghát in Pegu. *S. Pottingeri*, Prain, is a large species recently discovered in the Kachin hills.

1. **S. Roxburghii**, Bth.; Fl. Br. Ind. ii. 193; Brandis For. Fl. 143; Gamble Darj. List 28; Talbot Bomb. List 71. *Butea parviflora*, Roxb. Fl. Ind. iii. 248; Kurz For. Fl. i. 365. Vern. *Mala, mula, maula*, Hind.; *Gorári*, Oudh; *Debrela a*, Nep.; *Tarotrik*, Lepcha; *Moru, múrrd*, Kól; *Bandu, durang*, Kharwar; *Phulsun*, Mar.; *Porásu*, Uriya; *Mothuga tiga*, Koya; *Bodega tiga*, Reddi; *Pauknwè*, Burm.

A gigantic climbing shrub, often reaching 3 to 4 ft. in girth. *Bark* dark brown, rather rough, much fluted, and having horizontal ridges. *Wood* dark brown, very soft, fibrous, in concentric layers of very soft tissue with very large *pores*, alternating with bast layers which exude, on being cut, a bright red gum. The general appearance of a section is much like that of *Millettia auriculata*. The *pores* are surrounded by a ring, and the *medullary rays* are obscure, while small patches of bast tissue occur among the pores.

Sub-Himalayan tract from the Jumna eastwards, scarce in Dehra Dún compared with *Bauhinia Vahlii* and *Millettia auriculata*, more common eastwards as in Oudh; in the Darjeeling Terai and Dúars, very common and very troublesome; Assam, Eastern Bengal, Chittagong, and Burma, in all mixed forests; forests of Western India in the Konkan and N. Kanara, and of the east coast in Orissa and the Circars; hill regions of S. India.

One of the most destructive climbers of the Indian forests, and regularly cut wherever possible, especially in the N. Indian Sál forests and the teak forests of W. India. The gum is ruby-coloured and transparent, and resembles "*kino;*" the seeds give an oil and the bark a coarse fibre.

O 2927. Garhwal Forests (1874).
E 480. Darjeeling Terai (Manson).

22. BUTEA, Roxb.

Three species. *B. minor*, Ham.; Il. Br. Ind. ii. 195; Gamble Darj. List 28; Vern. *Bolatru*, Nep.; *Namosinglet*, Lepcha, is an erect or climbing shrub of the lower Eastern Himalaya and Assam, usually on dry slopes.

1. **B. frondosa**, Roxb. Fl. Ind. iii. 244; Fl. Br. Ind. ii. 194; Bedd. Fl. Sylv. t. 176; Brandis For. Fl. 142; Kurz For. Fl. i. 364; Gamble Darj. List 27; Talbot Bomb. List 72; Trimen Fl. Ceyl. ii. 66. Vern. *Dhák, phulla*, Kashmir; *Dhák, palás, kakria, kankrei, chichra*, Hind.; *Chalcha*, Bandelkhand; *Chiúla, puroha*, C.P.; *Palás*, Beng.; *Palási, bulyettra*, Nep.; *Lahokúng*, Lepcha; *Porásu*, Uriya; *Palashu*, Mechi; *Murút*, Kól; *Pharsa*, Baigas; *Parás, farás*, Behar; *Murúp*, Sonthal; *Chora, shora, khakra, kankra*, Merwara; *Murr*, Gondi; *Pharsa*, Kurku; *Porasan, parasu*, Tam.; *Modugu, mohtu*, Tel.; *Muttuga, thorás, muttala*, Kan.; *Parás, phulás, gas-kéla*, Mar.; *Phullas kakria*, Guz.; *Palásin samatha*, Mal.; *Pupalásu*, Trav. Hills; *Gas-kála*, Cingh.; *Pauk*, Burm.

A moderate-sized deciduous tree. *Bark* ½ inch thick, fibrous, grey, exfoliating in small irregular pieces; exuding from cuts and fissures,

a red juice which hardens into a ruby-coloured gum similar to *kino*. *Wood* grey or grey-brown, white or brown if cut up fresh and quickly seasoned, soft, not durable; no annual rings. *Pores* large, often subdivided, extremely scanty. *Medullary rays* broad and moderately broad, pale; the darker tissue between the rays is broken up into oblong patches by broad concentric bands of pale tissue similar in appearance to the medullary rays, alternating with dark patches, both distinctly visible on a radial section as long, irregular, alternate dark and light bands. The structure is like that of *Erythrina*, but the network is finer and the loose cellular tissue squares are smaller.

Throughout the plains of India, Burma, and Ceylon, usually in open country in grass lands and gregarious, more rarely scattered in mixed forests such as Sál. It thrives on black cotton-soil, also on salt lands and in water-logged places.

This well-known tree is remarkable for its brilliant scarlet-orange flowers with black sepals, which appear when the tree is leafless, and, as Brandis says, look "like 'fire on the horizon." The flowers appear in the beginning of the hot season; they give a yellow dye from which the "*keso*" powder used (or formerly used, for it seems to be now supplanted by other colours, perhaps aniline) at the Holi festival. The tree is valuable for covering salt lands, and will even grow on lands badly covered with "reh," and, if well grown, makes a handsome avenue tree, though leafless, or nearly so, when shade is most required.

The wood is not durable above ground, but is said to be much better under water, and is consequently used in Upper India for well-curbs and piles, also for the water-scoop of native wells, which is often made of thin slices of dhák wood joined with leather (Ibbetson, "Karnal Settlement Report"). If cut up green and seasoned in the plank it is likely to be a fair wood for rough boxes, but cut logs, if left long, get the wood badly discoloured and liable to speedy decay. The weight is given by Kyd as 32 lbs., by A. Mendis, Ceylon Collection, No. 11, as 38 lbs.; Brandis gives 31 to 36 lbs.; the specimens give an average of nearly 39 lbs. Kyd gives P = 335. Beddome says the wood is used for gunpowder charcoal. An analysis of 100 lbs. steam-dry wood gave 2 lbs. of ash, of which 0·76 lb. were potassium and sodium compounds, 0·63 lb. calcium carbonate, 0·28 lb. magnesium carbonate, and 0·28 lb. phosphates. The bark gives a coarse fibre, which is used for rough cordage and for caulking boats. The leaves are regularly used as plates, especially in S. India, also as a substitute for paper to wrap up parcels and for buffalo-fodder. Messrs. Gleadow and Gradon both say that the leaves are not eaten by goats. Incisions in the bark give a transparent ruby gum known as "Bengal kino," and sold as a medicine. It is obtained from small gashes made in the bark, from which it exudes and is collected. The right to collect kino gum over large areas is usually sold, *e.g.* in the Pathri Forest of Saharanpur, N.-W. Provinces.

Next to *Schleichera trijuga*, this tree is the most important one for growing lac upon, the insect being readily propagated by tying small pieces of the stick lac off a bearing tree on a branch of the one on which it is intended to grow. The quantity produced on *Butea* is greater than is given from other trees. The seeds are used in medicine as a purgative and vermifuge, and are said to be made into "condition balls" for horses (Graham Anderson, "Forest Trees in the Coffee Lands of S. Mysore"). The wood suffers a good deal from the attacks of insects. Mr. R. Thompson found it tunnelled by a Curculionid beetle, which proves to be *Sipalus granulatus*, Fabr. It is also one of the trees preferred by the destructive *Plocederus obesus*, Duporet (see also under Sál, *Odina*, etc.).

			lbs.
O	237.	**Garhwal (1868)**	—
C	1119.	**Ahiri Reserve, C.P. (R. Thompson)**	—
C	2759.	**Moharli Reserve, C.P. (Brandis)**	**36**
C	4889.	**Bétul, C.P. (S. G. Paranjpe)**	**32**
E	674.	**Rakti Forest, Darjeeling Terai (Manson)**	**31**
E	2345.	**Sivoke Forest " " (Gamble)**	**40**
D	4238.	**Nallamalai Hills, Kurnool (Sim)**	**44**
D	4309.	**Cuddapah (Gamble)**	**wet 65, dry 42**

2. **B. superba**, Roxb. Fl. Ind. iii. 247; Fl. Br. Ind. ii. 195; Brandis For. Fl. 143; Kurz For. Fl. i. 365; Talbot Bomb. List 72. Vern. *Yel parás, palasvel, beltivás,* Mar.; *Belia palás,* Berar; *Chilla, chihúnt,* Moughyr; *Samur,* Gondi; *Tunang,* Kurku; *Moduga,* Koya; *Dodharni,* Koderma; *Pauknwè,* Burm.

An immense climber. *Bark* dark brown, thick, very fibrous. *Wood* dark brown, very porous and fibrous. *Pores* very variable in size, small to very large, often much subdivided, thick-walled. *Medullary rays* very indistinct.

Oudh, Central India, the Konkan and Circars. Brandis gives also "Dehra Dún," but I have never seen it there or heard of it so far west along the Himalaya.

The flowers and leaves are scarcely distinguishable from those of *B. frondosa*, and, like it, it gives a gum kino. It is destructive in the forest, and requires to be cut.

C 4890. Bétul, C.P. (S. G. Paranjpe).

23. MASTERSIA, Benth. *M. assamica*, Bth. (*M. cleistocarpa*, Baker in Fl. Br. Ind. ii. 195) is a woody climber of the Eastern Himalaya and Assam.

24. DIOCLEA, H. B. K. *D. reflexa*, Hook. f.; Fl. Br. Ind. ii. 196; Kurz For. Fl. i. 379, is a large climbing shrub of Sylhet and the Andamans, and *D. javanica*, Benth. (*D. reflexa*, Hook. f. *l.c. in part;* Trimen Fl. Ceyl. ii. 68) is a large climber of Chittagong and Ceylon.

25. PUERARIA, DC.

A genus of climbing plants, a few of which only reach the size of being woody and possible injurers of forest trees. The most important is *P. tuberosa*, DC. *P. sikkimensis*, Prain (*P. tuberosa*, DC; Gamble Darj. List 28; Vern. *Belari*, Nep.; *Lungom*, Lepcha) is a large climber of the forests of the Darjeeling Terai, with soft spongy wood, recognized from *P. tuberosa* by having larger racemes of blue flowers and a rusty instead of a grey-silky pubescence. *P. Wallichii*, DC, is also a climbing shrub of the E. Himalaya. *P. Collettii*, Prain, is a shrub, erect when young, climbing when older, of the forests of Maymyo, the Shan Hills and other places in Upper Burma.

1. **P. tuberosa**, DC; Fl. Br. Ind. ii. 197; Brandis For. Fl. 141; Talbot Bomb. List 72. *Hedysarum tuberosum*, Roxb. Fl. Ind. iii. 363. Vern. *Siali, saloha, badar,* Punjab; *Bildi kand, billi, birali, pona,* Kumaon; *Sirála,* Garhwal; *Ghorbel,* Berar; *Gora bél,* Merwara; *Dari, gumodi,* Tel.

A large tuberous-rooted deciduous climber. *Bark* brown, ½ in. thick, peeling off in vertical strings. *Wood* very porous, soft, perishable, white when fresh cut, afterwards turning brown, fibrous. *Pores* very large, in light-coloured rings. *Medullary rays* not traceable.

Sub-Himalayan tract from the Indus eastwards to Nepal; Behar, Chota Nagpore, C.P., Deccan, Orissa, the Circars, the Konkan and Kanara; often cultivated.

This plant has pretty blue flowers which appear before the leaves; its root is a huge tuber which is eaten and used in medicine. The tuber is cut up and given as food to tonga-ponies on the Simla road (Collett).

O 4647. Kasumri, Saharanpur Forests (Gamble).

26. ATYLOSIA, W. and A. A genus of herbs and shrubs, only one or two of which are of any size. *A. Candollei*, W. and A.; Fl. Br. Ind. ii. 212; Trimen Fl. Ceyl. ii. 78; Vern. *Et-tora*, Cingh., is a handsome erect shrub of the Nilgiri Hills, at 5–8000 ft., and of the patanas of the Ceylon mountains; it is very common, especially on grassy slopes with patches of bushy vegetation such as *Rhodomyrtus*, *Hypericum mysorense*, etc. *A. lineata*, W. and A. and *A. sericea*, Bth. are smaller but pretty shrubs of rather lower elevations on the mountains of S. India. *A. mollis*, Bth. is a climbing shrub of the Western Himalaya, very common in places in Jaunsar and Tehri-Garhwal at 4–6000 ft.; while *A. crassa*, Prain, is a similar species of the plains from Dehra Dún southwards and in Burma.

27. CAJANUS, DC. *C. indicus*, Spr.; Fl. Br. Ind. ii. 217 (*Cytisus Cajan*, Roxb. Fl. Ind. iii. 325), is a shrub largely cultivated, especially in forest regions in India and throughout the tropics, for the sake of its seeds (Vern. *Arhar, arhar dal.* Hind., Beng.; *Túr, tura*, Mar.; *Tuvarai*, Tam.; *Kandalu*, Tel.; *Togari*, Kan.; *Pèzigôn*, Burm.), which are much used for food. The branches and leaves are used as cattle-fodder.

28. CYLISTA, Ait. *C. scariosa*, Ait.; Fl. Br. Ind. ii. 219; Roxb. Fl. Ind. iii. 320; Kurz For. Fl. i. 377; Talbot Bomb. List 73; Vern. *Ranguera*, Bombay, is a climbing shrub of South and West India and Burma.

29. RHYNCHOSIA, Lour. contains several small shrubs or climbers. *R. pseudo-cajan*, Camb.; Fl. Br. Ind. ii. 223, is not uncommon in the forests of long-leaved pine in the Western Himalaya, and is frequent in the valley of the Tons.

30. FLEMINGIA, Roxb.

Several species, mostly shrubs of various sizes, some of them important in the forest undergrowth. Among such are *F. Chappar*, Ham., a round-leaved species with flowers in large rounded bracts, which, in some places, as in parts of the Dún Sál forests (Motichúr Valley), in the Eng forests of Burma and in the Northern Circars Sál forests, forms a dense shrubby underwood. Of other large-bracted species, *F. strobilifera*, Br. and *F. bracteata*, Wight, are also species of the underwood of tree forest in various parts of India, while *F. fruticulosa*, Wall. is characteristic of grass lands in the Western Himalaya, usually above 5000 ft.

F. stricta, Roxb. Fl. Ind. iii. 342; Fl. Br. Ind. 228; Gamble Darj. List 28; Kurz For. Fl. i. 375; Vern. *Batwási*, Nep., is a large undershrub of valleys in the Lower Himalaya and sub-Himalayan forests from Dehra Dún to Assam, also in Burma, characterized by densely imbricating narrow bracts and triquetrous branches. *F. congesta*, Roxb., is another shrub of similar range, common in savannah lands in Bengal and Burma, and extending north-west to Dehra Dún and southwards to the Circars and Kanara. *F. involucrata*, Bth., is a blue-flowered, soft-headed shrub of grass lands in the Sikkim Terai, Duárs and Assam. *F. Grahamiana*, W. and A. is a Nilgiri shrub which, besides *F. congesta*, Roxb., gives the "*Waras*" dye resembling "*Kamila*," which is obtained from the glands on the pods (see Agric. Ledger, No. 16 (1898)).

1. **F. semialata**, Roxb. Fl. Ind. iii. 340; Kurz For. Fl. i. 374. *F. congesta*, Roxb. var. *semialata*; Fl. Br. Ind. ii. 229; Trimen Fl. Ceyl. ii. 87; Gamble Darj. List 28. Vern. *Bhalia*, Hind.; *Batwási*, Nep.; *Mipitmúk*, Lepcha; *Thagyanè*, Burm.

A tall shrub. *Wood* white, soft. *Pores* small, scanty, in lines of pale tissue arranged concentrically and alternately with harder tissue without pores. *Medullary rays* moderately broad.

Himalaya and sub-Himalayan forests, from Chamba to Bhutan; Assam, Khasia and Naga Hills; Parasnáth in Chota Nagpore; Nilgiris; Burma, north to Kachin Hills.

E 3279. Dainah Forest, Western Dúars, Bengal (Gamble).

TRIBE VII. DALBERGIEÆ.

31. DALBERGIA, Linn. f.

A very important genus in Indian Forest economy, as it contains two of the most valuable and important of Indian forest trees, besides several others of interest on account of their woods, their products or their importance in Sylviculture. There are about 36 species in the three sections, and of these about one-half are trees and one-half climbing or straggling shrubs. The following account of the chief species of forest interest has been taken from the Fl. Br. Ind. as amended by the Notes given in Dr. Prain's paper in *Journ. As. Soc. Beng.* lxvi. ii. 442.

Wood **soft to very hard; in *D. Sissoo, latifolia, cultrata* and *Oliveri* it is dark-coloured—red, brown, purple or black; in *D.***

lanceolaria, paniculata, hircina, etc., it is white or grey without heartwood. In all the *pores* are scanty, often subdivided, in patches of light tissue joined by concentric belts or lines of similar structure, which vary from rather broad and irregular in *D. Sissoo* to fine and regular in *D. cultrata* and *Oliveri*, and from numerous in *D. cultrata* to very few in *D. hircina*, or none at all in *D. nigrescens*. *Medullary rays* fine, uniform, often very short.

Subgenus 1. SISSOA, Benth. Eighteen species.

D. pseudo-Sissoo, Miq. (*D. Championii*, Thw.; Fl. Br. Ind. ii. 231; Trimen Fl. Ceyl. ii. 88); Vern. *Bambara-wel*, Cingh., is a scandent shrub of the moist region of Ceylon. *D. foliacea*, Wall.; Fl. Br. Ind. ii. 232, is a tree of the Eastern Himalaya, ascending to 4000 ft.; Assam, the Khasia Hills and Sylhet; and Burma. *D. rubiginosa*, Roxb. Fl. Ind. iii. 231; Fl. Br. Ind. ii. 232; Kurz For. Fl. i. 347; Talbot Bomb. List 75, is a climbing shrub of South India, the Ghâts of Kanara and the forests around Kambala-taung in Burma. *D. Gardneriana*, Benth., is a climbing shrub of the hills of South India. *D. confertiflora*, Bth.; Fl. Br. Ind. ii. 233; Talbot Bomb. List 75, is a climbing shrub of Sylhet, Chittagong, the Konkan and Burma, also very common in the Andaman Islands. *D. Collettii*, Prain in Journ. As. Soc. lxvi. ii. 445, is a tree, 25 to 30 ft. high, found in the Shan Hills at 4–5000 ft. and at other places in Upper Burma. *D. Melanoxylon*, Guill. et Perr. (*D. Stocksii*, Benth.; Fl. Br. Ind. ii. 234; Talbot Bomb. List 75), is a climbing shrub, wild or more often planted, in the Konkan and N. Kanara, and known as "Chinese Blackwood." *D. sympathetica*, Nimmo; Fl. Br. Ind. ii. 234; Talbot Bomb. List 75; Vern. *Pendguliyel, yekyel*, Mar., is a climbing shrub of deciduous forests on the Western Coast with large curved spines on its stems. *D. velutina*, Bth., is a climbing shrub of Eastern Bengal and Burma; and *D. Milletti*, Bth., a climbing shrub of the Khasia Hills. *D. tamarindifolia*, Roxb. Fl. Ind. iii. 233; Fl. Br. Ind. ii. 234; Kurz For. Fl. i. 348; Gamble Darj. List 29; Talbot Bomb. List 75; Vern. *Damar*, Nep.; *Teihyaprik, shengrik*, Lepcha; *Keti*, Sylhet, is a large climbing shrub, found in the Eastern Himalaya from Nepal to Assam, the Khasia Hills, Eastern Bengal, the Andamans and the Ghâts of North Kanara. *D. Kingiana*, Prain in Journ. As. Soc. Beng. lxvii. ii. 289, is a climbing shrub of the Kachin Hills.

1. **D. Sissoo**, Roxb. Fl. Ind. iii. 223; Fl. Br. Ind. ii. 321; Bedd. Fl. Sylv. t. 25; Brandis For. Fl. 149, t. 24; Gamble Darj. List 28; Talbot Bomb. List 74. The Sissoo. Vern. *Shisham, sissu, sissúi*, Hind.; *Shewa*, Pushtu; *Táli, safedar, shín, nelkar*, Pb.; *Sissái*, Oudh; *Yette*, Tam.

A large deciduous tree. *Bark* between ⅓ and ½ in. thick, grey, exfoliating in narrow longitudinal strips. *Wood* very hard, close-grained; sapwood small, white; heartwood brown, with darker longitudinal veins. *Annual rings* not distinctly marked. *Pores* large and moderate-sized, scanty, in light-coloured irregular patches which are joined by fine, wavy, more or less concentric streaks, which are frequently interrupted and often very oblique; well defined on a longitudinal section, often filled with resin. *Medullary rays* pale, very fine, uniform and equidistant, numerous. Changa-Manga specimens show occasional medullary spots or patches.

Sub-Himalayan tract and Himalayan valleys up to 3000 ft., from the Indus to Assam, gregarious in forest on the banks of sandy, stony torrential rivers as, for an example, the upper portion of the Ganges about Hardwar, and thence to the foot of the hills. But it may grow and grow well on higher lands, though not gregariously unless planted. Cultivated and self-sown in the rest of the plain country of India. Beddome writes of it as "abundant in the plains of Central India"; Van Someren, as wild in Mysore; and Talbot, as "believed to be indigenous in Guzerat;" but I feel sure these are errors, and that, as Brandis says, it is never really indigenous outside the sub-Himalayan belt.

The Sissoo tree, in suitable places, grows to a fairly large size, reaching a height of 60 ft. or more. It is very rarely straight in bole, being more ordinarily curved or twisted, and very often irregularly buttressed, so that it is rare that straight logs of any length can be obtained from it. In girth it is not often found much over 6 ft., but occasionally it may run to 10 or even 12 ft. When growing gregariously, the trees grow close together, with a considerable number to the acre; but the shade given is quite light, and perhaps Sissoo may be said to have the lightest cover of any of the Indian forest trees of any importance. On river-bed lands, the gregarious forests of Sissoo are the result of seeds which are washed down during high floods, and left on the banks and islands as the flood subsides. As the pod is indehiscent, it is the pod itself, which is very thin and light, and so easily transported by water, which is sown; the thin outer covering rapidly decays, and the seed germinates, making at once a great length of root-growth compared with its stem-growth above ground (Eardley-Wilmot, in "Stray Leaves," "Indian Forester," vol. xxv. Appx., says "six feet in the first year"). This ensures the seedlings from being washed away when further floods come and raise the ground on which it grows, or deepen the channel alongside, leaving the new crop above water-level. Year by year the ground is raised until it gets to the height of the highest floods, or the alongside channels deepen; and consequently in suitable places succession patches of Sissoo may be seen, in succession of age, on adjoining islands or terraces. When young the growth of Sissoo is very quick, as it gets older it gets slower. Pole forests of Sissoo thin themselves gradually, for the Sissoo demands much light. It often happens that, quickly as a forest of Sissoo has been formed, as quickly it may again be destroyed in heavy floods, so that the working of a forest by area is apt to be difficult to arrange. Sissoo reproduces itself naturally also on higher land if the soil be not too wet or water-logged: this is clearly seen in the tea-estates of the Dehra Dún, where seedlings and also large numbers of root-suckers come up so fast as to require some trouble to kill if there are more than are required for shade. Artificially, Sissoo may easily be grown from sowings in suitable places, but transplanting is difficult. Eardley-Wilmot says it requires that the seedling should be grown in "six feet cylindrical tiles" and transplanted in holes of the same depth; but this would be prohibitive in cost, and has not always been necessary, for good trees have often been raised from transplanted seedlings, where the roots have had to be cut, but which have otherwise been carefully lifted and judiciously put in (see also Ribbentrop, "Arboriculture in the Punjab," p. 93). Except Teak, Sissoo has been more planted than perhaps any Indian tree, and attention need only be invited to the splendid success obtained at Changa-Manga in the Punjab, the result of sowings in irrigated land; to the growth at Shahdera near Lahore, where the land (called "Sailaba" land) is liable to yearly flood by the overflow water of the Ravi; and to the canal plantations throughout Northern India. In other provinces also plantations have been successfully made, as, for instance, on the islands of the Cauvery river, in Madras. The timber of the trees raised under irrigation in plantations is, however, of poor quality compared with naturally grown wood, the amount of sapwood is larger, and the wood is often attacked by fungi (*e.g.* the serious damage done in some parts of Changa-Manga by *Polystictus* (*Polyporus*) *egregius*, Massee, a large bracket-like fungus of parasitic character). Sissoo also coppices well, but reproduces itself better from suckers, and it is best, if such reproduction is required, to cut the tree at a short distance below ground, when numerous suckers shortly appear all round, sent up from the roots. It is often planted in avenues, but it is not good for the purpose, the cover being too light. It is the chief tree used to shade tea in Dehra Dún.

The rate of growth of Sissoo is fast. Brandis says that it attains, under favourable circumstances, 2½ ft. in girth in 12, and 4½ ft. in 30 years, which is equivalent to a growth of 2½ and 3½ rings per inch of radius respectively. Countings in the Changa-Manga Plantation gave, in 1877 (see Ed. 1, p. 125), a rate of 1·55 rings for trees of an average age of 12 years, so that such tree gave an average girth of 4 ft. But other countings in Changa-Manga gave an average of 2½ rings, or a girth of 30 in. at 12 years, which is what Brandis estimated. The Jhelum Sailaba Plantations gave a girth of 4 ft. at 30 years. Lately, measurements reported by Mr. Gleadow from Oudh, for natural forests on nearly 900 trees, of an average age of 15½ years, gave an average girth of 35 in., and height 50 ft., which is equivalent to an average growth of 2·8 rings per inch. Generally speaking, we can recognize that the growth of Sissoo is quick, at any rate for several years, getting slower afterwards, but that no safe general data can be given on which the rotation can be calculated. This must be done

separately for each locality, and especially with reference to whether the trees were grown naturally or artificially.

The wood is very durable, seasons well, and does not warp or split. It is highly esteemed for all purposes where strength and elasticity are required. Clifford says that "in strength it is only inferior to Sál, while in many other useful qualities it surpasses 'it, and has the advantage of being lighter. For felloes and naves of wheels and 'carved work of every description, for framings of carriages and similar work, it is 'unsurpassed by any other wood, owing to its fine seasoning and standing qualities." It is extensively used for boat-building, carts and carriages, agricultural implements, in construction, and especially for furniture. As a furniture-wood and for carving, it is probably the finest wood in India, and it is in regular demand for these purposes all over the North. The "Simla" and "Saharanpur" carvings are well known.

Formerly it was more extensively used for gun-carriages than it can be at present, owing to the comparatively small supply. With regard to its durability and strength as a wood for wheels, Clifford says, "The wheels of our ordnance carriages have 'never failed, however arduous or lengthened the service has been on which they have 'been employed, of which no more striking example can be furnished than the cam-'paign in Afghanistan, about the most trying country in the world for wheels. Some 'of our batteries served throughout the campaign, went to Bameean and even to the 'Hindoo Koosh, and came back again to India without a break-down, while Royal 'Artillery wheels, built of the very best materials Woolwich could produce, specially for 'Indian service, almost fell to pieces after a few months' exposure and service on the 'plains of India." A pair of wheels exhibited at Paris in 1900 were much admired.

Sissoo wood is an excellent fuel, good pieces burning almost like coal; it also makes excellent charcoal. An analysis of 100 lbs. steam-dry clean wood gave 1·17 lbs. of ash, made up as follows:—

	lbs.	per cent.
Soluble potassium and sodium compounds	0·44	37·6
Phosphates of iron, calcium, etc.	0·13	11·1
Calcium carbonate	0·47	40·2
Magnesium carbonate	0·10	8·5
Silica and impurities	0·03	2·6

showing what a large quantity of lime the tree requires.

The weight and transverse strength have been calculated by the following experiments:—

Experiment by whom conducted.	Year.	Wood whence procured.	Weight.	No. of experiments.	Size of bar used.	Value of P.
			lbs.		ft. in. in.	
Cunningham	1854	Gwalior	48	4	2 × 1 × 1	697
Campbell	—	Bengal	56	1	6 × 2 × 2	923
Skinner, No. 56	1862	"	50	—	3 × 1$\frac{1}{2}$ × 1$\frac{1}{2}$; 2 × 1 × 1	870
Russell	"	"	55·5	—	– × 1 × 1	967
Baker	1829	Northern Bengal (Cossipore, 1819)	49	9	7 × 2 × 2	762
"	"	Northern Bengal (Cossipore factory)	45	6	6 × 2 × 2	734
"	"	Northern Bengal	—	8	3 × 1$\frac{1}{2}$ × 1	709
"	"	" "	—	13	2 × 1 × 1	606
Brandis	1864	Bengal	49	15	6 × 2 × 2	738
"	"	"	47	18	6 × 2 × 1$\frac{1}{3}$	740
"	1865–66	"	46	9	6 × 2 × 2	787
"	"	"	47	17	3 × 1 × 1	869
"	"	"	44	11	2 × 1 × 1	854
"	"	"	45	14	2 × 1 × 0$\frac{7}{8}$	919
Molesworth	1878	—	52	—	—	760; E = 8800
Specimens examined	1899	Various, see list	48	—	—	—

		lbs.
P 146.	Giri Valley, Punjab, 3000 ft.	44
P 884.	Multan, „ (Baden-Powell)	52
P 1205.	Changa-Manga Plantation (9 specimens)	—
P 1347.	Peraghaib and Saila Plantations, Jhelum (8 specimens)	—
P 4743.	Shahdera Plantation, Lahore (C. G. Rogers)	48
P 4744.	Changa-Manga Plantation, Punjab „	50
O 205.	Garhwal (1868)	52
O 537.	Debra Dún (O'Callaghan)	—
O 1460.	Bahraich, Oudh (Eardley-Wilmot)	49
O 1486.	Kheri, „	52
E 675.	Rakti Forest, Darjeeling Terai (Manson)	47
E 2347.	Sukna „ „ „ (Gamble)	46
E 634.	Eastern Dúars, Assam (G. Mann)	42
E 3588.	Darjeeling Terai	—
E 3709.	R. Bot. Garden, Calcutta (King, 1881)	45

Nordlinger's Sections, vol. 4.

2. **D. latifolia,** Roxb. Fl. Ind. iii. 221; Fl. Br. Ind. ii. 231; Bedd. Fl. Sylv. t. 24; Brandis For. Fl. 148; Kurz For. Fl. i. 342; Gamble Darj. List 29; Talbot Bomb. List 74. The Blackwood or Rosewood of Southern India. Vern. *Sitsal*, Beng., Nep., Oudh; *Shisham, sisu, kalarukh, bhotbeula, sissúi*, Mar.; *Sissu*, Guz.; *Sirás, sissu, sirsa, sissa*, Mandla; *Sissua*, Uriya; *Iti, eruvadi, thothagatti*, Tam.; *Jitegi, yerugudu, jitangi*, Tel.; *Biti, thodagatti*, Kan.; *Bhotuk*, Bhil; *Serís*, Gondi; *Serisso*, Kurku; *Rutê*, Kól; *Satsiyar*, Sonthal; *Ruzerap*, Mechi; *Iridi*, Palkonda; *Jitiyegishi*, Koya.

A deciduous tree attaining a large size in South India. *Bark* $\frac{1}{3}$ in. thick, grey, with irregular short cracks, exfoliating in thin, fibrous longitudinal flakes. *Wood* extremely hard, close-grained: sapwood yellow, small; heartwood dark purple, with black longitudinal streaks; no distinct *annual rings*. *Pores* moderate-sized to large, often subdivided, irregular, scanty, in patches of light tissue, which patches are generally joined by narrow, white, wavy, interrupted, concentric lines. *Medullary rays* fine, numerous, uniform, equidistant and very short.

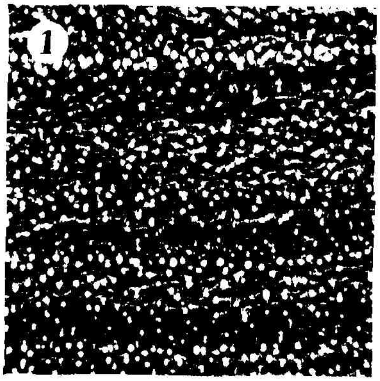
Throughout the whole of the peninsula of India, extending northwards through the Central Provinces, Chota Nagpore and Behar to the Sikkim Himalaya and the Bahraich and Gonda forests of Oudh, where, however, it is scarce and small. It reaches its largest size on the W. Ghâts, where it is found along the whole length, in deciduous forests, rising to 3500 ft. It is also found of fine size in the forests of the Circars. It is not found in Burma or Ceylon.

This fine tree, which, like Sissoo, affords a valuable furniture-wood, is found in dry forests, associated with Teak and Bamboo, but is also found in moist evergreen jungles (Beddome). Bourdillon says that though so common it is nowhere very abundant, rarely reaching a percentage of more than 2 to 3 of the species composing the forest. It may reach a height of 80 ft., with a girth of 12 or 15 ft. (20 ft. Beddome), but it is of slow growth, especially at first. It is easily propagated by seed, and comes up well self-sown; it also coppices well. In North India it assumes the form of a low, very much branching small tree with a curving bole; but in its real home, in the South, it grows tall and straight, and it has a much thicker and denser crown than Sissoo, giving a much deeper shade. It is sometimes planted to shade coffee.

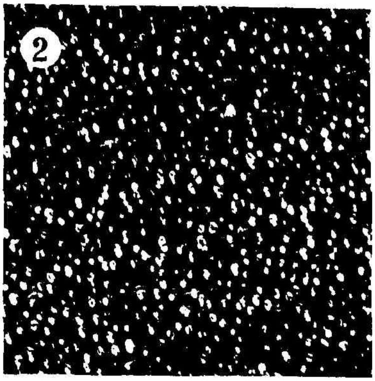
Foulkes, in his "Notes on Timber Trees of S. Kanara," says that in that district it is found both on gneiss and laterite, but grows best on the soil produced by the latter rock at the foot of the Ghâts; that it has a long taproot which penetrates deep; that as the pods remain on the tree in the hot season, and fall only when the rains have begun, the seed is preserved from possible fire, and reproduction is good.

Not much is known as regards the rate of growth: Brandis gives 5 to 9 rings per inch of radius; Bourdillon considers that a tree 2 ft. in diameter would be about 100 years old; some of the specimens show a growth of 8 rings per inch. It is probable, therefore, that it takes usually not less than 100 years to reach a girth of 6 ft. without bark. A. W. Lushington mentions that 20 samples in Cochin territory on the Western

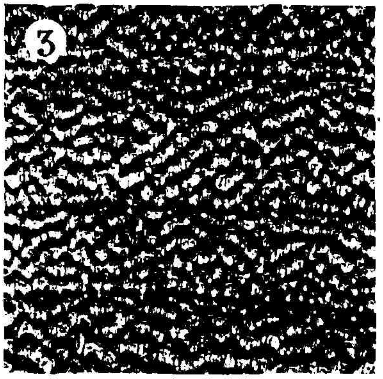
VI.



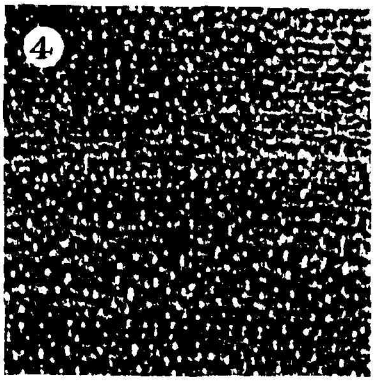
DALBERGIA LATIFOLIA.



PTEROCARPUS MARSUPIUM.

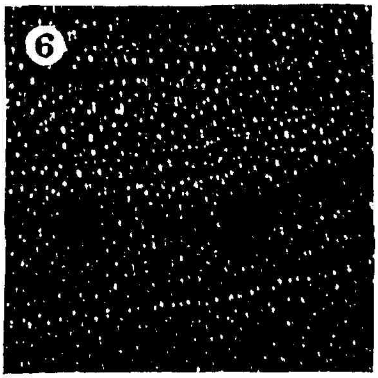


CASSIA FISTULA.



BAUHINIA PURPUREA.

XYLIA DOLABRIFORMIS.



PROSOPIS SPICIGERA.

(*Magnified* 3½ *times.*)

Ghâts gave an average of 3 rings per inch, so that we may assume, as is natural, that the rate is faster in moist climates than in dry ones.

The timber is a valuable furniture-wood. It is known in England as "Rosewood," and in India as "Bombay blackwood," and is exported to Europe from the forests of Kanara, Malabar and Travancore. Wood sent to London in 1878 fetched £13 10s. per ton (5s. 5d. per cubic foot); but this was an exceptionally large piece, of handsome grain. In the "Report on the Blackwood or Rosewood of S. India," in "Indian Forester," vol. xx. Appx., which contains much information on the subject, the selling prices from the Madras forests are given at from Rs.10 to Rs.75 per ton, according to distance from the coast; those of Travancore at Rs.1 8a. per cubic foot for good quality; those of Bombay at from Rs.30 to Rs.50 per ton. The London rate for good wood is generally about £10 per ton, so that it seems as if there were still scope for greater activity in utilizing the English market for the sale of the best pieces produced. I have myself known splendid squares of large size in the forests of the South-East Wynaad to be sold at the low rate of 4 to 6 annas a cubic foot only.

The chief use of the wood is for furniture; the fine old carved chairs, tables, sideboards, etc., of Bombay are well known, but are apparently less manufactured now than they used to be. It is also used for cart-wheels, agricultural implements, gun-carriages, knee-timbers of boats, and in the Darjeeling Hills universally for the handles of "kukris" made by Nepalese. It has been used for sleepers, and found suitable and fairly durable for that purpose on the Mysore State Railway; but the wood is too valuable for furniture to be wasted on a purpose for which other and commoner woods of less handsome grain will do equally well.

The weight and transverse strength have been determined by the following experiments:—

Experiments by whom conducted.	Year.	Wood whence procured.	Weight.	No. of experiments.	Size of bar.	Value of P.
			lbs.		ft. in. in.	
Wallich, No. 52	—	India	66·5	—	—	—
Puckle	1859	Mysore	51	4	2 × 1 × 1	1052
Maitland	1862	Anamalais	51	—	3 × 1½ × 1½	746 to 996
Skinner. No. 54	1862	"	50	—	Various	912
Baker	1829	Malabar	55	3	6 × 2 × 2	822
R. Thompson	1873	C. P.	66	—	—	—
H. H. O'Connell	1886	Coimbatore	54	3	5½ × 1 × 1 5½ × 1½ × 1½ 5½ × 2 × 2	a = 0·01032
Talbot	1885	Bombay	48	5	6 × 2 × 2	837
Specimens examined	1878–99	Various	55		—	—

Brandis says the value of P may be taken at 950, which is probably a little high; the weight is, perhaps, on an average, 50 lbs. for dry wood.

The wood is a good fuel, but naturally is rarely used for the purpose. Chips of it are burnt in cressets at native festivals, and give a splendid light (Graham Anderson).

			lbs.
P	464, 467.	Ajmere	—
C	187.	Mandla, C.P. (1869)	46
C	2984.	Jabalpur (1863)	53
C	1146.	Ahiri Reserve, C.P. (R. Thompson)	58
C	2732.	Moharli Reserve, C.P. (Brandis)	52
C	955.	Daugs Forest, Guzerat, Bombay (Shuttleworth)	53
C	3456, 3682.	Palamow Forests, Chota Nagpore (Gamble)	52
C	3522.	Khurdha Forests, Orissa (Gamble)	61
C	1236, 1303.	Gumoúr Forests, Ganjam (Dampier)	64
C	3836.	Mojagodo Forest, Ganjam (Gamble)	72
E	672.	Bamunpokri Forest, Darjeeling Terai (Manson)	50
E	2348.	" " " (Gamble)	60
E	3675.	Darjeeling Terai	54
E	492.	Khookloong Forest, Darjeeling Terai (Manson)	—

		lbs.
C 4058.	Godavari Forests, Madras (Gamble)	56
D 2044.	Mysore (Kurz)	54
D 1072.	N. Arcot (Beddome)	57
D 1476.	Anamalai Hills, Coimbatore	—
W 1227.	North Kanara (Barrett)	54
W 729, 855.	South Kanara (Cherry)	55 and 49
W 3851.	Mudumalai Forest, S.-E. Wynaad, Nilgiris	50
No. 24, Salem Collection		62

Nordlinger's Sections, vol. 7 (Tab. VI. 1).

The specimen, No. W 3851, is probably *D. latifolia*, var. *sissoides*, which seems to deserve specific rank, as both flowers and leaves differ from those of *D. latifolia* proper. It is the *Eeruputu* of Palghat axe-men (Beddome).

3. **D. ovata**, Grah.; Fl. Br. Ind. ii. 231; Kurz For. Fl. i. 343. Vern. *Madamu*, Burm.

A deciduous tree. *Bark* light brown, fibrous, with shallow vertical clefts. *Wood* greyish- or yellowish-brown, moderately hard, close-grained. *Annual rings* faint. *Pores* moderate-sized and large, scanty and unevenly distributed, in small rings of pale tissue joined by narrow white, slightly wavy, more or less concentric pale lines. *Medullary rays* fine, very numerous, regular.

Upper mixed forests of Burma, especially along streams.

These recently received specimens (1901) agree fairly well in structure, No. D 4898 being perhaps somewhat different, and possibly a different species. Some of them may belong to var. *obtusifolia* (*D. glauca*, Wall.; Kurz For. Fl. i. 343). Vern. *Madamu*, Burm.

		lbs.
B 4857.	Magwe, Burma (S. E. Jenkins)	—
B 4898.	Minbu „ (Calthrop)	47
B 5015.	Prome „	54
B 5032.	Rangoon „	42
B 5058.	Thongwa „	54
B 5102.	Toungoo „	48

4. **D. rimosa**, Roxb. Fl. Ind. iii. 233; Fl. Br. Ind. ii. 232; Brandis For. Fl. 148. *D. foliacea*, Gamble Darj. List 29, *non* Wall. Vern. *Tatebiri*, Nep.

A large straggling shrub or small tree. *Bark* thin, dark greyish-brown, roughish. *Wood* white, soft, like that of *D. stipulacea*, with a small dark heartwood. *Pores* large, fairly numerous, in pale undulating rather broad concentric bands which anastomoze. *Medullary rays* moderately broad, numerous. *Annual rings* (?) marked by a broad dark hard band.

Wet forests in the Darjeeling Terai and Duárs; Eastern Bengal; along streams in the upper mixed forests of Burma.

For correction of the identification of this species I am indebted to Sir D. Brandis. *D. foliacea* has many more, and obtuse, leaflets.

		lbs.	
E 3274.	Muraghát Reserve, W. Duárs (Gamble)	—	
E 4879.	Sylhet (Babu Kripa Nath De)	45	Vern. *Kaogrum*.

This last *may* be *D. foliacea*.

5. **D. congesta**, Grah.; Fl. Br. Ind. ii. 232.

A climbing shrub. *Bark* grey, smooth, with vertical lenticels. *Wood* white, soft, porous. *Pores* moderate-sized to large, often subdivided, scanty, joined by concentric pale wavy bands. *Medullary rays* numerous, regular, bent round the pores.

Forests of the Nilgiris, in sholas at 5–7000 ft.

W 4259. Melúr, Nilgiris, 6000 ft. (Gamble).

6. D. cultrata, Grah.; Fl. Br. Ind. ii. 233; Kurz For. Fl. i. 342. Vern. *Yindaik*, Burm.

A moderate-sized deciduous tree. *Bark* ½ in. thick, smooth, with short transverse clefts. *Wood* black with dark purple streaks, very hard; sapwood pale brown. *Pores* moderate-sized, very scanty, in small patches of light tissue with large cells, joined by somewhat wavy concentric narrow belts of the same. These belts make a pretty grain on a tangential section. *Medullary rays* very fine, very numerous, short.

Common in all deciduous forests, especially the upper mixed, Savannah and Eng forests throughout Burma from the Shan Hills southwards.

A splendid wood, resembling ebony at a distance, but with a totally different structure. Kurz, following Brandis, says it is used for ploughs, bows and the handles of dáhs and spears. It has sometimes been used for carvings.

According to Benson, W = 83 lbs.: Brandis' Burma List, 1862, No. 36, gives 64 lbs.; Kurz the same, perhaps copied: the specimens give 69 and 70 lbs.; the average may be taken at 70 probably.

Brandis' List gives the girth at 6 ft. from the ground as 9 ft., and the height to first branch 35 ft., so that the tree grows to a good size and deserves to be better known, and to have more attention paid to it than has apparently been hitherto given.

		lbs.
B 2521.	Burma (Brandis, 1862)	70
B 2728.	Nawing Forests, Prome (1858)	69
B 2697.	Tavoy (Wallich, 1828)	—

Subgenus 2. DALBERGARIA, Bth. Fourteen species.

D. purpurea, Wall.; Fl. Br. Ind. ii. 235 (*D. paniculata*, Kurz For. Fl. i. 345); Vern. *Tapauk*, Burma, is a large tree of mixed dry forests in Pegu, with a strong compact white wood, which turns a pale yellow in colour, and is good for building, while that of the true *D. paniculata*, Roxb. certainly is not. *D. burmanica*, Prain, is a tree of the Ruby Mines District in Upper Burma, with foliage much resembling that of *D. tamarindifolia*. *D. assamica*, Benth.; Fl. Br. Ind. ii. 235; Vern. *Medeloa*, Ass., is a tree of the Central and Eastern Himalaya. In the Fl. Br. Ind. it is said to be a "twiner," but S. E. Peal and Prain describe it as a tree, and it seems doubtful if it extends so far west as Kumaon, if indeed as far as Sikkim. *D. glomeriflora*, Kurz.; Fl. Br. Ind. ii. 236; Kurz For. Fl. i. 345, is a scarce tree of the Prome Hills. *D. Thomsoni*, Bth.; Fl. Br. Ind. ii. 236, is a climbing shrub of Assam and the Khasia Hills. *D. cana*, Grah.; Fl. Br. Ind. ii. 237; Kurz For. Fl. i. 344, is a tree of Burma with a heavy white wood which turns brown, but is not durable. *D. Wattii*, Clarke, is a spreading tree of the forests of Manipur at 3–5000 ft.; and *D. Prazeri*, Prain, is a tree of Burma.

7. D. lanceolaria, Linn.; Fl. Br. Ind. ii. 235; Brandis For. Fl. 151; Gamble Darj. List 29; Talbot Bomb. List 75; Trimen Fl. Ceyl. ii. 88. *D. frondosa*, Roxb. Fl. Ind. iii. 226; Bedd. Fl. Sylv. lxxxviii. Vern. *Takoli*, *bithúa*, Hind.; *Bander siris*, Nep.; *Barbat*, *parbati*, Banswarra; *Gengri*, Panch Mehals; *Harráni*, Dharwar; *Nal valanga*, Tam.; *Pedda sopara*, *yerra patsaru*, *pasarganni*, Tel.; *Dandous*, *dandoshi*, *kaurchi*, Mar.; *Piri*, Kól; *Passi*, Merwara; *Sirsi*, *passi*, Jeypore.

A deciduous tree. *Bark* ¼ in. thick, compact, grey, smooth, exfoliating in thin rounded patches. *Wood* white or yellowish-white, moderately hard, no heartwood. *Annual rings* (?) marked by thin, concentric lines. *Pores* scanty, large and moderate-sized, often oval and subdivided, very prominent on a longitudinal section, surrounded by a thin ring of light tissue, alone or joined by very fine wavy and broken faint concentric bands. *Medullary rays* very fine, numerous, regularly distributed.

Sub-Himalayan tract from the Jumna eastwards, ascending to 2500 ft.; Central India, Khandésh and Bombay forests from the Konkan southwards, common in N. Kanara; Circars, Deccan and Carnatic, not common; low country of Ceylon, rare.

This tree has the appearance of an *Albizzia*, and is handsome when in good flower and leaf. It is found in the Darjeeling Terai, along rivers and in the forests of Sissoo.

Skinner, No. 53, gives for the weight 62 lbs. per cubic foot; Wallich, 46 lbs.; the specimens give only 33 to 44 lbs. Skinner also gives P = 1003, but it is probable that he has not described the right wood, for, although he gives the correct Telugu name, yet he calls his specimens (No. 53, p. 75) *Moukshow*, Burm., and "Moulmein lancewood;" while Kurz, the latest authority, does not give *D. lanceolaria* as occurring in Burma. J. W. Oliver suggests that "*Moukshow*" is perhaps a corruption of "sauk yo," the Lower Burma name of a species of *Dalbergia*, possibly *D. Oliveri*, Gamble. Skinner says that one log was brought from the Western Coast, and another by Conductor Bowman from Burma. Beddome says the timber is useful for building purposes.

		lbs.
O 5092.	Maiapur Block, Saharanpur (Babu U. N. Kanjilal) . . .	50
C 1144.	Ahiri Reserve, C.P. (R. Thompson)	—
E 618.	Champasari Forest, Darjeeling Terai (Bonham-Carter) . .	33
E 2346.	Bamunpokri, Darjeeling Terai (Gamble)	44
D 4236.	Nallamalai Hills, Kurnool (Gamble)	40

8. **D. volubilis**, Roxb. Fl. Ind. iii. 231; Fl. Br. Ind. 235; Brandis For. Fl. 152; Kurz For. Fl. i. 346; Talbot Bomb. List 75. Vern. *Bhatia*, Kumaon; *Bankharra*, Oudh; *Bamba*, Khond; *Gumlap tiga*, Reddi; *Alei*, Bombay; *Padôn*, Burm.

A large climbing shrub. *Bark* thin, brown, peeling off in flakes. *Wood* light brown, hard. *Pores* small to very large, scanty, joined by occasional faint concentric lines, which are often without pores. *Medullary rays* very fine, very numerous.

Central and Eastern Himalaya from Kumaon to Sikkim; Oudh, Behar, C.P., Chota Nagpore, South and West India.

C 3450. Ramundag Reserve, Palamow (Gamble).

9. **D. paniculata**, Roxb. Fl. Ind. iii. 227; Fl. Br. Ind. ii. 236; Bedd. Fl. Sylv. lxxxviii.; Brandis For. Fl. 150; Talbot Bomb. List 75. Vern. *Katsirsa*, Oudh; *Dhobein, dhohein, pássi, satpuria*, Hind.; *Dhupi*, Uriya; *Patchalai, valange, vellaringi, eravu*, Tam.; *Potrum, porilla, patsuru, patsari, toper*, Tel.; *Sondarra, sheodur, topia*, Mar.; *Hasár guniri, hassuruguunni, bilugatha, pachári*, Kan.; *Piangani, velittha vitti, ottu tholi*, Mal.; *Padri*, Gondi, Bhíl; *Phassi*, Kurku; *Passi*, Melghát; *Surteli*, Baiga; *Porapatcha*, Reddi.

A large deciduous tree. *Bark* $\frac{1}{8}$ in. thick, compact, grey, smooth, with many horizontal cracks. *Wood* pale yellowish-white, soft to moderately hard, with numerous narrow, wavy anastomozing bands of pale loose tissue, about 100 to 150 per inch; the wood in concentric belts separated by narrow bands of bast tissue about $1\frac{1}{2}$ to 2 per inch. *Pores* moderate-sized, scanty, often subdivided. *Medullary rays* fine, fairly numerous. The bast belts resemble those in *Cadaba*, *Niebuhria* and some other genera.

Forests of Central and South India, said by Brandis to extend north to Oudh, and to the Siwalik tract west of the Jumna river, ascending to 2500 ft.

A remarkable tree, easily recognized by its tall grey stem, which, in Deccan ruined forests, stands out from the remains of the old forest, having been the only tree too useless to cut. Beddome says the wood is "used for building and common purposes," but I never heard of its being used. Fuel billets of it are usually rejected. Skinner, No. 55, gives W = 48 lbs., R. Thompson the same; the specimens give an average of 40 lbs. Skinner gives P = 872; his specimens must have been of some other wood.

In regard to the bands of bast tissue, T. G. Hill, in the *Journal of Botany*, xv. (1901)

quoted in Ind. For. xxviii. 113, says "The narrow zones are of the nature of phloem, 'accompanied by a certain amount of cambium. The phloem contains well-marked 'sieve-tubes with sieve-plates. The peculiarity of structure is attributed to the 'formation of successive cambium rings."

		lbs.
C 1115.	Ahiri Reserve, C.P. (R. Thompson)	32
C 2928.	Seoni, C.P. (Brandis)	46
C 5108.	W. Khandésh, Bombay	40
D 4240.	Nallamalai Hills, Kurnool (Sim)	43

10. D. hircina, Benth.; Fl. Br. Ind. ii. 236; Brandis For. Fl. 151; Gamble Darj. List 29. *D. stenocarpa*, Kurz; Fl. Br. Ind. ii. 238. Vern. *Saras, bandír, tantia, gogera*, Hind.; *Bander siris, tatebiri*, Nep.; *Bulphet*, Lepcha.

A moderate-sized tree. *Bark* dark brown, ¼ to ½ in. thick, rough, peeling off in small squares. *Wood* greyish-white, moderately hard, no heartwood. *Annual rings* fairly distinct. *Pores* large and moderate-sized, scanty, often subdivided into 2 or 3, prominent on a vertical section. Concentric lines very few, fine, faint. *Medullary rays* very fine, very numerous, regularly distributed.

Outer Himalayan Hills from the Jumna to Sikkim, at 2500–5500 ft., local, in ravines.

		lbs.
H 4494.	Malkot Forests, Dehra Dún, 3000 ft, (Gamble)	39

11. D. Kurzii, Prain in Journ. As. Soc. Beng. lxvi. ii. 450. *D. purpurea*, Kurz For. Fl. i. 344. Vern. *Thitpôk*, Burm.

A deciduous tree. *Wood* light yellowish-white, hard. *Pores* scanty, large and moderate-sized, in pale patches, joined by rather regular concentric bands of the same structure, which are numerous, broad, wavy and anastomoze. *Medullary rays* numerous, very fine, equidistant. The pores are conspicuous on a vertical section, as are the concentric bands which appear as pale regular lines. Resembles *D. lanceolaria* and *D. hircina* in appearance, *D. cultrata* and *D. Oliveri* in structure.

Burma, from the Shan Hills to Pegu and Tenasserim, in mixed forests.

Kurz says the heartwood is black and ebony-like, which may well be, the specimen examined having only sapwood. If so, it is almost exactly like that of *D. cultrata*. The identification of the specimen is certainly doubtful.

		lbs.
B 2523.	Burma (Brandis, 1862, No. 133)	42

12. D. stipulacea, Roxb. Fl. Ind. iii. 233; Fl. Br. Ind. ii. 237; Kurz For. Fl. i. 346; Gamble Darj. List 29. Vern. *Tatebiri*, Nep.; *Garodosal*, Mechi; *Tón-nyok*, Lepcha; *Dauktalaung*, Burm.

A large climbing or erect shrub. *Wood* hard, greyish-brown or greyish-white, with a purplish-brown heartwood. *Pores* scanty, of various sizes, often subdivided, in pale rings, alone or joined by pale, undulating concentric bands which often anastomoze. *Medullary rays* fine, very numerous.

Eastern Himalaya, ascending to 4000 ft.; Assam, Khasia Hills, Chittagong; mixed and tropical forests, ascending the hills in Burma, and found northwards to Myitkyina.

As Prain explains, this is a shrub in open land, but a climber in thick forest.

		lbs.
E 574.	Khookloong Forest, Darjeeling Terai (Manson)	—
E 2849.	Sivoke " " " (Gamble)	48

13. D. Oliveri, Gamble; Prain in Journ. As. Soc. Beng. lxvi. ii. 451. Vern. *Tamulan*, Burm.

A large tree. *Bark* light brown, moderately thick. *Wood* hard close-grained, sapwood white, heartwood dark red-brown, in colour like good "*Padauk*." *Pores* large, very scanty, sometimes subdivided often resinous, always conspicuous on a vertical section, surrounded by pale rings joined by very numerous, regular, concentric, wavy often anastomozing pale lines. *Medullary rays* very fine, very numerous, regular.

Engdaing forests of Upper Burma, Wuntho and Bhamo, discovered by J. W. Oliver.

A very handsome wood, very like some of the South American rosewoods. It is used for axe-handles, the head being made of it, and fitted with an iron axe on one side. It also resembles "*Padauk*," but differs in structure.

		lbs.
B 4435.	Attaran Forests (J. W. Oliver), sapwood only	—
B 4436.	Katha (J. W. Oliver)	66
B 4750.	Upper Burma (J. Nisbet)	66

Subgenus 3. SELENOLOBIUM, Benth. Four species.

D. torta, Grah. (*D. monosperma*, Dalz.; Fl. Br. Ind. ii. 237; Talbot Bomb. List 75; Trimen Fl. Ceyl. ii. 89, *Drepanocarpus monospermus*, Kurz For. Fl. i. 337); Vern. *Panchioli*, Beng., is a climbing shrub of the coasts of the Sundarbans, Western and Southern India, Burma and Ceylon. *D. reniformis*, Roxb. Fl. Ind. iii. 226; Fl. Br. Ind. ii. 238 (*Drepanocarpus reniformis*, Kurz For. Fl. i. 336); Vern. *Kures*, Sylhet; *Taukma*, Burm., is a large, crooked, bushy tree of Sylhet and Burma, found in swamp forests. Roxburgh says the wood burns with a green flame and is excellent for burning lime. *D. parviflora*, Roxb. Fl. Ind. iii. 225 (*Drepanocarpus Cumingii*, Kurz For. Fl. i. 336), is a large climbing shrub of the Andaman Islands and Tenasserim. Kurz says, "It is a dye-wood and furnishes the '*Kayu-lakka*' of commerce," but information regarding "*Kayu-lakka*" seems to be wanting.

14. D. spinosa, Roxb. Fl. Ind. iii. 233; Fl. Br. Ind. ii. 238; Talbot Bomb. List 75. *Drepanocarpus spinosus*, Kurz For. Fl. i. 337. Vern. *Amanta*, Beng.; *Yechinya*, Burm.

A large shrub, sometimes scandent. *Bark* blackish-grey, rough, vertically fissured. *Wood* brownish-white, in alternate bands of varying width of woody and bast texture and with a dark-red hard centre. *Pores* moderately large, very scanty, unevenly distributed, joined, in the woody rings, by many very close wavy white concentric bands. *Medullary rays* very fine, close and regular.

Coasts of India and Burma, in tidal forests.

Kurz speaks of the wood as "soft, beautifully silvery white, close and straight-'grained," which does not agree well with our specimen. He also makes the following interesting statement, which seems well worthy of more extended investigation: "The 'roots powdered absorb alcohol, and a spoonful of the powder in a tumblerful of water 'is said to be sufficient to destroy in less than half an hour the effects of alcohol, even 'in cases bordering on delirium tremens."

D 4118. S. Arcot coast forests, Madras (Wooldridge).

B 291, Burma (1867), 38 lbs. and B 2522, Burma (1862), 39 lbs. are *Thitsanwin*, Burm. No. 123 of Brandis' collection. Kurz gives *Thitsanwin* as *D. nigrescens*, Kurz. Prain reduces Kurz' *D. nigrescens* to *D. paniculata*, Roxb. Our specimens do not show the peculiar structure of that species, but seem to belong to *Dalbergia*, though in them the concentric lines which in some species I have described are already faint, have disappeared. Except for the absence of these lines the wood resembles that of *D. hircina*. It does not resemble that of *D. paniculata*.

32. PTEROCARPUS, Linn.

The identification of the species of this genus has recently been carefully investigated by Dr. Prain (see "Ind. Forester," xxvi., Appx.). As regards *P. santalinus*, Linn. f. and *P. Marsupium*, Roxb., there is no difficulty, but he has found it necessary to show that, except for a few specimens from cultivated trees, there is no foundation for the statement in Fl. Br. Ind. that *P. indicus*, Willd. is a native of India proper. The results of his inquiries are: (1) that *P. indicus*, Willd. is the Malayan seashore tree which is found northwards as far as Tavoy and Tenasserim; (2) that the Andaman species, now so largely exported under the name "*Padauk*," is *P. dalbergioides*, Roxb.; and that (3) the inland Burma tree is *P. macrocarpus*, Kurz, collected by Brandis, Kurz and others in various places throughout Burma as far north as the Chin Hills. The next point is the identification with one or other of these species of the wood specimens given under *P. indicus*, Willd. in Ed. 1 of this work, p. 131. The Andaman specimens are doubtless all *P. dalbergioides*, Roxb.; the Tavoy one most probably *P. indicus*, Willd.; and those from Pegu and Martaban are doubtful, but most probably *P. macrocarpus*, Kurz. This is what I propose to assume: in structure all these woods are very similar, but that of *P. dalbergioides* is softer, lighter and of a brighter red colour.

Wood very hard, close-grained, yellowish-brown, red or purplish-red. *Pores* variable, small to large, scanty, in patches of pale tissue (having larger cells than the rest of the wood, as in *Dalbergia* and *Ougeinia*) joined by more or less fine, wavy, concentric lines of similar texture. *Medullary rays* very fine, uniform, equidistant. In colour the five species differ: *P. santalinus* has its wood of a very dark claret-red colour; *P. indicus* and *P. macrocarpus* of a dark brick-red colour; *P. dalbergioides* has a bright red wood often streaked with black; while the wood of *P. Marsupium* is of a brown colour with a yellowish tinge.

1. **P. indicus,** Willd.; Fl. Br. Ind. ii. 238 *in part*; Roxb. Fl. Ind. iii. 238; Bedd. Fl. Sylv. t. 23; Kurz For. Fl. i. 349 *in part*. Vern. *Padauk*, Burm.

A deciduous tree. *Bark* olive-grey. *Wood* hard: sapwood small, grey, heartwood dark brick-red. *Pores* moderate-sized to large, often subdivided, in patches of pale tissue, joined by irregular, pale, wavy, interrupted bands of varying breadth. *Medullary rays* extremely fine, very numerous, uniform and equidistant.

Coast forests of Tenasserim and Tavoy in Burma.

A pretty tree, often cultivated for its sweet-scented flowers. The wood is of fine quality, but is not so useful as that of the Andaman tree, *P. dalbergioides*. It is probably the wood experimented with in the following trials:—

	W	P
Simpson, with Tenasserim wood bars 3′ 1½″ 1½″ gave	62	781
	81	1575
Benson, " " " 3′ 1·4″ 1·4″ "	71	1033

It is used for building, carts, etc., and may be employed for most purposes for which Andaman Padauk is useful, though it is not quite so easy to work.

	lbs.
B 2708. Tavoy (Wallich, 1828)	62

It is right to note that the identification, though probable, is not quite certain.

2. **P. dalbergioides,** Roxb. Fl. Ind. iii. 236. *P. indicus*, Willd.; Fl. Br. Ind. ii. 238 *in part*; Kurz For. Fl. i. 349 *in part*. Andaman Redwood or Andaman Padauk. Vern. *Padauk*, Burm.; *Chalanga-dá*, And.

A very large tree. *Wood* moderately hard: sapwood grey, small; heartwood bright red, streaked with brown and black. *Pores* scanty, moderate-sized to large, filled with resin, surrounded with pale rings

and joined by narrow wavy concentric lines, prominent on a vertical section. *Medullary rays* extremely fine, very numerous, uniform and equidistant.

Forests of the Andaman Islands, not gregarious.

The Padauk is the principal timber tree of the Andaman Islands, and its wood has of recent years obtained a good place in the markets of Europe and America as a handsome wood for furniture, parquet floors, railway-carriages, door-frames, balustrades, etc. In India it has long been in use as a gun-carriage wood, and stores of it are kept in the arsenals of Calcutta and Madras and the Kidderpore Dockyard for military purposes. Extensive works for the extraction of the timber have now been set on foot in the Andamans, and the logs are sent for sale in Europe and elsewhere in cargo-loads. The following remarks were published in Ed. 1 of this work in 1880:—

"Major Protheroe describes a tree felled in 1876 with a clear stem of 65 ft. and a 'girth of 17 ft., and says that the wood of the root is closer-grained, darker-coloured 'and more beautifully marked than that of the stem. The plank sent to the Paris 'Exhibition of 1878 measured nearly 4 ft. across. In London, a portion of the same 'log from which the plank was cut fetched a price of £17 10*s*. per ton, or nearly Rs.4 'per cubic foot, while three logs lately sold in Calcutta fetched Rs.60 per ton. Furni-'ture made from Padauk wood and exhibited at Paris in 1878 by Messrs. Jackson and 'Graham was much admired. They reported on it as follows:—

"'This is a straight-grown wood, with rather a coarse open grain, but without any 'strong figure or markings. When first cut it is of reddish-brown colour, but it fades 'to much the same colour as teak—a wood it resembles very much, and it is about as 'hard, but much heavier. From the six specimen trees sent us, we imagine that it does 'not grow to any great size. The largest sent to us measured 16 ft. long × 1 ft. '7 in. × 1 ft. 6 in. We consider it suitable for all kinds of furniture. We 'manufactured it into a suite of morning-room furniture, which was exhibited at the 'Paris Exhibition, and which stood the test of a very hot summer in a most satisfactory 'manner.'" Early in 1899 Padauk wood was selling in London at 6*s*. 6*d*. per cubic foot. In 1900, at the Paris Exhibition piano cases of carved Padauk, exhibited by Messrs. Hallé & Co., were much admired.

In this place may also be quoted some of the information which I got together in 1895 for a note on Padauk for the "Indian Forester" (see p. 7, vol. xxi.).

"As a practical example of the value of 'Padauk' as a wood for interior decoration 'we may instance the ballroom of one of the chief houses in Simla, which was laid 'down by a recent owner a few years ago in Padauk wood, with results which have 'left nothing to be desired in point either of beauty of appearance or of suitability for 'dancing. The floor has stood as well, if not better, than Teak wood would have done. 'In the same way the use of Padauk wood is extending on the Continent of Europe for 'the construction and laying down of 'parquet' floors, a purpose for which we can 'scarcely imagine any wood to be better adapted.

"In the Handbook issued in 1892 by Mr. E. Thurston, then Reporter on Economic 'Products to the Government on India, on the gradual introduction of Padauk wood into 'use and of its gradually increased exploitation in the Andamans, it was pointed out that 'the permanent introduction of the wood into the London market might be said to date 'from the time of the Indo-Colonial Exhibition. The Handbook gives an account of 'the use of the wood by Messrs. Coles & Co., of Coleman Street, in building a hand-rail 'and a dado to the side of a stone staircase at 45, Fenchurch Street, and it is stated 'that for both purposes the wood came out of very fine figure and of excellent tone and 'colour. Padauk is also said to have been used by Mr. Joseph Roberts of Bigg Market, 'Newcastle, in fitting up a new pharmacy in that city. The effect produced by the 'use of polished Padauk for windows, doors, and casings is said to have been unique 'and to recall the finest examples of Spanish Mahogany. Another London firm has 'lately employed it for the fittings of a telephone-room.

"Lately it was suggested by the Government of India that some of the panelling 'and furniture of the Imperial Institute might with advantage be made of Padauk, and 'this has now been done, with, we are given to understand, excellent results. It has 'been tried, and is, we hear, now extensively used, by makers of pianofortes, and cases 'made of it ought to look remarkably well.

"Lastly, among instances of the spread of the use of Padauk timber, we may refer 'to its employment in America in the building of Pullman cars, for which it has been

'most successful. We hope that this may induce the very conservative builders of 'railway carriages in this country to substitute it to some extent, instead of Teak, for 'their purposes; and, if we are correctly informed, there is one reason which ought 'forcibly to appeal to the travelling public, and that is, that in case of accidents 'Padauk breaks clean and does not, like so many other woods, go into splinters likely 'to inflict dangerous wounds."

At one time the market was rather spoilt by large consignments of "yellow" wood being sent for sale instead of the "red," the yellow wood possibly being the produce of *P. indicus* or *P. macrocarpus*, and prices fell; but this has been altered recently, and only red Andaman wood is now sent. The latest reported London rate is from 4*s.* to 5*s.* per cubic foot.

The weight of the wood is about 48 lbs. per cubic foot. Bennett's experiments, made in 1872, gave 49½ lbs. and P = 827. The wood seasons well, works well, and takes a good polish. It shrinks very little, does not crack or split, and is not liable to be attacked by white ants or by xylophagous insects. Nor is it subject to dry rot. It is, however, when in sea-water, bored by the teredo. The usual sizes of logs or squares are large, and the latter run up to a length of 40 ft., occasionally even 60 ft. with 3 ft. siding. The tree gives a kind of gum "kino."

It is understood to be easily propagated, but it comes up well naturally, though the seedlings do not thrive unless they are given light by the removal of trees over them. Much attention is now being paid by the Forest Department in the Andamans to the reproduction of Padauk and the increase in the proportion of it in the forests. Home's Valuation Surveys of 1874 gave an average of 7 mature trees per acre, which is very good, and if this is for anything like the whole area, the supply must be sufficient to last a considerable while, without any diminution of the permanent annual yield. On this subject see also Mr. H. C. Hill's Report and the yearly Departmental Reports.

		lbs.
B 2207.	Andaman Islands (Col. Ford, 1866)	43
B 2494.	„ „ (Home, 1874, No. 1)	55
B 526.	„ „ (Gen. Barwell)	46

3. **P. macrocarpus,** Kurz; Fl. Br. Ind. ii. 239; Kurz For. Fl. i. 349. Burma Padauk. Vern. *Padauk*, Burm.

A deciduous tree. *Wood* hard, dark brick-red, close-grained, structure similar to that of *P. indicus.*

Eng and upper mixed forests of Burma: in the Shan, Chin and Karen Hills, in Upper Burma; also in Pegu, but scarce only in Martaban and not reported from Tenasserim.

This is the common *inland* Padauk tree, and to this species I have referred Brandis' specimen, as Prain so identifies Brandis' herbarium specimens. The wood is harder than that of *P. dalbergioides*, and heavier, and is probably not used outside Burma, but is a fine handsome wood having much the character of Sissoo, though redder in colour. B 548 from Martaban might be this or *P. indicus*, but I think it is most probably this species, as it agrees exactly with Col. Bingham's specimen No. B 4909, which is authentic.

		lbs.
B 548.	Martaban (Seaton)	60
B 2524.	Pegu (Brandis, 1862, No. 39)	60
B 4909.	Upper Burma (Bingham)	58

4. **P. santalinus,** Linn. f.; Fl. Br. Ind. ii. 239; Roxb. Fl. Ind. iii. 234; Bedd. Fl. Sylv. t. 22. The Red Sanders. Vern. *Lal chandan, rakta chandan, seyapu chandanum*, Tam.; *Erra chandanum*, Tel.; *Honné*, Kan.

A small or moderate-sized tree. *Bark* blackish-brown, deeply cleft both vertically and horizontally into rectangular plates. *Wood* extremely hard: sapwood white, heartwood dark claret-red to almost black, but always with a deep red tinge, orange-red when fresh cut, the shavings giving an orange-red colour. *Pores* moderate-sized, scattered, very scanty, joined by fine pale, undulating concentric lines at unequal distances, difficult to see on an old specimen. *Medullary rays* fine, numerous, equidistant.

South India, occupying only a small area, most of it in the Cuddapah District, wit small portions of the adjoining Districts of Nellore and N. Arcot, and an outlier in th Nagri Hills of Chingleput; that is to say, chiefly on the Seshachellam, Lankamalai an Veligonda ranges of hills, on an area of perhaps about 6000 square miles in extent i all, so that in range there is perhaps no important Indian tree of so circumscribed distribution (see also my account in "Indian Forester," ix. 354).

The Red Sanders is a very pretty tree, having an upright bole, only branching a some height above ground into a rounded head. Its foliage is dense, but as th trees do not usually grow close, it gives little shade; nor does it bear well the shad of other trees. It flowers in April and May, seeding the next February and March The seed germinates readily, and natural reproduction is sure and easy, but, like many other important Indian trees, the shoots die off yearly, while the root increases, unti a time comes when the shoots are strong enough to resist the sun and hot winds an grow on into trees. It reproduces well in coppice and by suckers. The aspect of Red Sanders forest (this was really written in 1883, and by now possibly most of th forests are greatly improved through protection from fire) is that of a stony hill countr covered with tufts of lemon grass (*Andropogon Nardus* and *Schœnanthus*) and wit poles of Red Sanders at intervals. It prefers moderate slopes, low ridges and spurs but is also found on quite steep hillsides, preferring a northern or eastern aspect. I its home, the annual rainfall is about 42 in., and the shade temperature varies only from about 70 to 120 degrees Fahr.; the chief rainfall is that of the N.-E. monsoon in October-November, but a little also comes with the S.-W. winds in July to September The rock it likes mostly consists of shales and sandstone of the submetamorphic o transition series.

The wood is very highly prized for house-posts, and large sums are often given fo good posts by wealthy native gentlemen, who take a pride in having their veranda-posts of some hard timber prettily carved and ornamented. The chief woods thus use are the Red Sanders and its frequent associate the *Thamba* (*Shorea Tumbuggaia*). It is also used for plough-poles universally in the S. Deccan, and for other agricultural purposes. Formerly, the great use of the wood, however, was as a dye, and for this purpose large shipments used to be annually made from Madras to Europe, but it appears that the demand has now very greatly declined. In the five years ending with 1882–83, 12,782 tons were exported to the United Kingdom, 1116 tons to France, and 1687 tons to other Indian and Ceylon ports, the whole valued at 5½ lakhs of rupees. These shipments consisted only of old dry pieces found lying in the forests, with stumps and roots, and it is possible that to some extent the falling off in outturn may be due to the supplies from this source having become exhausted, but is possibly quite as much due to artificial dyes having supplanted "redwood" as they already have supplanted madder, cochineal and other natural dyes, and bid fair soon to supplant indigo. The value of redwood as a dye is due to a red colouring principle, "santalin," which is soluble in alcohol and ether, but not in water. Dissolved in alcohol, it dyes cloth a beautiful salmon-pink colour. It is also used in medicine by natives as an astringent, but does not seem to be of much value. The wood is also very extensively used for carved work, and large quantities of Red Sanders wood idols and other carved figures are yearly made and sold at the Tirupatti temples, chiefly to pilgrims. It is also excellent for boxes, picture-frames and other joinery purposes.

Red Sanders has been, very successfully, cultivated in plantation on good land on the flat near Kodúr, in the Cuddapah District, but only on a small area of about 20 acres. It was planted in 1865. This plantation I described in "Indian Forester," ix. 546, in 1883, and the average girth of the trees then was 17·88 in. and height 40 ft. The average annual increment was found to be very nearly 3 tons per acre. The method of planting was described in a paper read at the Forest Conference of 1875 by H. H. Yarde. It was all done with basket plants, which after planting were watered in dry weather. The leaves were much cut formerly for manure for fields, but the practice has now ceased, I understand.

As regards growth, not much is known, Beddome mentions a tree which had 3 rings per inch, but it is probable that the rate is slower than that in the natural forests. Skinner, No. 112, gives the weight of the wood at 70 lbs.; our specimens give 76 to 79 lbs.; perhaps 75 lbs. would be a good average. Skinner gives P = 975.

		lbs.
D 2066.	Mysore	76
D 2917.	Madras (Brandis)	—
D 1075.	North Arcot (with sapwood) (Beddome)	66

		lbs.
D 3151.	Cuddapah, Madras (Higgens)	77
D 4202.	" " (rootwood) (Gamble)	79

5. P. Marsupium, Roxb. Fl. Ind. iii. 234; Fl. Br. Ind. ii. 239; Bedd. Fl. Sylv. t. 21; Brandis For. Fl. 152; Talbot Bomb. List 76; Trimen Fl. Ceyl. ii. 90. Vern. *Bija, bijasár, bijasál, piasál,* Hind.; *Byasa, piasál,* Uriya; *Dhorbeula, ásan, bibla,* Mar.; *Peddei, bijo,* Gondi; *Peddagi, yeanga, yegi, yegisa, pedéga, pedéi,* Tel.; *Vengai,* Tam.; *Benga, honné, hond,* Kan.; *Bijaira,* Bijeragogarh; *Radat bera,* Bhil; *Hitún, hid,* Kól; *Murga,* Sonthal; *Beeya persar,* Kharwar; *Paisar,* Mal Pahari; *Ragat bera, dhorbicula,* Berar; *Vengis,* Khond; *Amé,* Saora; *Vengsha,* Reddi; *'Gammala,* Cingh.

A large deciduous tree. *Bark* ½ in. thick, grey, with long vertical cracks, exfoliating in small pieces of irregular shape and size. *Wood* very hard, close-grained, giving a red resin: sapwood small; heartwood yellowish-brown, with darker streaks. *Pores* moderate-sized and large, often subdivided, scanty, resinous, uniformly distributed in pale patches which are joined by fine, white, wavy, often interrupted concentric lines; marked on a vertical section. *Medullary rays* very fine, numerous, short, uniform and equidistant.

Central and Southern India, chiefly in deciduous forest, extending north to the hills of Behar, Banda, and finally to the Kumaon Terai; low country of Ceylon.

As Beddome remarks, Vengai is, after Teak and Blackwood, the most important tree of S. India; and is especially used in Mysore. It is found in the mixed forests, but not gregariously, and the largest trees are met with in suitable places in the Western Ghát country and in the valleys of the Godavari and Circars. Foulkes says that in S. Kanara it does best on a well-drained clayey soil. The wood is durable, seasons well and takes a fine polish; the heartwood is full of gum resin and stains yellow when damp. The wood is much used for door- and window-frames, posts and beams, furniture, agricultural implements, cart and boat building. It has also been used for sleepers. Out of 25 sleepers which had been down seven to eight years on the Mysore State Railway, there were found, when taken up, 9 good, 11 still serviceable, and 5 bad. It has also been used to a certain extent on the Holkar and Neemuch and other lines. In Kurnool the wood is never used in the construction of private houses, but is in demand for public choultries, temples and temple cars, but especially for spokes and felloes, for which it is preferred to any other timber (F. Lodge). It yields, from wounds in the bark, a red gum-resin called "kino," a valuable astringent, much used in medicine, and containing about 75 per cent. of tannic acid. There is a considerable demand for the kino gum for export, much of it going to France. In India its value is about Rs.2 per pound.

The weight and transverse strength have been determined by the following experiments:—

Experiment by whom conducted.	Year.	Wood whence procured.	Weight.	No. of experiments.	Size of bar used.	Value of P
			lbs.		ft. in. in.	
Wallich, No. 224 . .	—	Travancore	47	—	—	—
Puckle	1859	Mysore	56	—	—	—
"	"	"	51	—	2 × 1 × 1	821
Skinner, No. 111 . . .	1862	South India	56	—	—	868
French	1861	Madras (Erode workshops)	—	3	1 × 1 × 1	511
Baker (Nos. 501 to 504) .	1829	Baggri Forest, Midnapore	63	4	7 × 2 × 2	687
O'Connell	1886	Coimbatore	61	—	—	$a = 0·0112$
Talbot	1885	Bombay	50	2	6 × 2 × 2	701

The average weight of the specimens examined is 53 lbs. per cubic foot, and perhaps the best average weight to take on the whole is 55 lbs.

The seed crop is not annual but intermittent, and the seeds do not always germinate well. The pods fall in the dry season, and are liable to be burnt. Foulkes says, "Fell-'ings should be so conducted that the soil is sufficiently exposed for the seed to lodge 'well and be protected from fire; and the soil should if possible be prepared for its 'lodgment" ("Timber Trees of South Kanara"). A. Lushington (Ind. For. xxviii. 141) says that fires do not exterminate Vengai so easily as Teak, in North Coimbatore.

		lbs.
C 175.	Mandla, Central Provinces (1870)	47
C 1105.	Ahiri Reserve, Central Provinces (R. Thompson)	58
C 2741.	Moharli Reserve, Central Provinces (Brandis)	49
C 2918.	Seoni, Central Provinces	56
C 3686.	Ramundag Reserve, Palamow (Gamble)	—
C 3542.	Khurdha Forests, Orissa (Gamble)	54
C 1238.	Gumsúr, Madras (Dampier)	56
C 4059.	Godavari Forests	56
W 742, 752, 850.	South Kanara (Cherry)	48, 45, and 53
D 1061.	South Arcot (Beddome)	—
D 1086.	Madura (Beddome)	59
No. 39, Salem Collection		52
	Nordlinger's Sections, vol. 10 (Tab. VI. 2).	

33. PONGAMIA, Vent.

1. P. glabra, Vent.; Fl. Br. Ind. ii. 240; Bedd. Fl. Sylv. t. 177; Brandis For. Fl. 153; Kurz For. Fl. i. 335; Gamble Darj. List 30; Talbot Bomb. List 76; Trimen Fl. Ceyl. ii. 91. *Galedupa indica*, Lam.; Roxb. Fl. Ind. iii. 239. Vern. *Karanj*, *papar*, Hind.; *Dalkaramcha*, *karanja*, *kerrán*, *pitagoria*, Beng.; *Sadun*, Nep.; *Koranjú*, Uriya; *Pongá*, Tam.; *Kanga*, *pungu*, *kaniga*, *kanuga*, *ganuga*, Tel.; *Pongú*, Mal.; *Karandjé*, Khond; *Khawári*, *karmúj*, Sirguja; *Garanji*, Gondi; *Charr*, Ajmere; *Húngay*, *pong*, Kan.; *Thinwin*, Burm.

A moderate-sized tree, almost evergreen. *Bark* soft, ⅓ in. thick, greyish-brown, covered with tubercles. *Wood* moderately hard, white, turning yellow on exposure. *Annual rings* indistinct. *Pores* moderate-sized, scanty, included in and joined by white, wavy, concentric anastomozing bands of loose texture, which alternate with bands of darker colour and firmer texture. The bands are not quite continuous, as they sometimes stop and sometimes anastomoze. *Medullary rays* fine, white, numerous and uniformly distributed.

Tidal and beach forests and along tidal river-banks all round India, Burma and Ceylon (Kurz and Prain). Also along streams and rivers in the forests of South and Central India, extending northwards to the Himalaya (Brandis, Beddome, etc.) and eastwards to the Shan Hills of Burma. Much cultivated.

Prain says very positively that this is only a coast tree, and that inland it only occurs as a planted species, but in long experience and many journeys in the forests of Bengal, Behar, Orissa, the Circars, Deccan, etc., I can only say that I have constantly met with it in places where there was no reason to doubt its being truly wild, and this view seems to be fully supported by Brandis, Beddome and Talbot. It certainly is very largely cultivated, especially in S. India, where it is grown as a pollard, the loppings being used as fodder and more especially to be ploughed into ricefields as manure. It is often planted as an avenue tree and in gardens, as it grows fast and is handsome, but it tends to branch very soon and requires careful pruning to get it a proper bole.

Weight, according to Skinner, No. 107, 40 lbs. per cubic foot; Bourdillon gives 49 lbs.; specimens examined give an average of 42 lbs. Skinner gives P = 686. The wood is not durable, and is readily eaten by insects, but is improved by seasoning in water. In Lower Bengal it is used for oil-mills and firewood; in South India for solid cart-wheels. Heinig (Sundarbans Working Plan) says the wood is liable to the attacks of insects, and so is used only for fuel. The seeds are used in native medicine;

they also give a thick, red-brown oil used for burning, and medicinally as an application for skin diseases, for which it is said to be very efficacious. The tree is easily grown from cuttings.

		lbs.
P 457.	Ajmere	45
C 1133.	Ahiri Reserve, Central Provinces (R. Thompson)	38
E 411.	Sundarbans (Richardson)	43

Nordlinger's Sections, vol. 10.

34. DERRIS, Loureiro.

A large genus of about 28 species, all but five being climbing shrubs, scarce and scattered. Ten species are found in Burma, six in Ceylon, ten in Northern or Eastern Bengal and ten in Western or Southern India. Of the four trees, besides the one described below, *D. dalbergioides*, Baker; Fl. Br. Ind. ii. 24, is a small tree of Martaban and Tenasserim; *D. cuneifolia*, Bth., and *D. microptera*, Bth., are trees of the Sikkim Himalaya usually described as climbers. *D. sinuata*, Thw.; Fl. Br. Ind. ii. 246; Kurz For. Fl. i. 340; Trimen Fl. Ceyl. ii. 94; Vern. *Sundri-lota, mahajani-lota*, Beng.; *Myaukgônnyin*, Burm., is a large climbing shrub of the coast forests of the Sundarbans, Burma and Ceylon. *D. latifolia*, Prain in Journ. As. Soc. Beng. lxvii. ii. 2, 288, is a large tree of the Kachin hills at 4000 ft.

1. D. scandens, Bth.; Fl. Br. Ind. ii. 240; Brandis For. Fl. 154; Kurz For. Fl. 339; Talbot Bomb. List 76; Trimen Fl. Ceyl. ii. 91. *Dalbergia scandens*, Roxb. Fl. Ind. iii. 232. Vern. *Gunj*, Punjab; *Nas-bél*, C.P.; *Noa lota*, Beng.; *Golasi, potra, nalavail*, Gondi; *Chelatali badu, nalla tiga*, Tel.; *Tupail*, Mar.; *Tekil*, Tam.; *Kala-wél*, Cingh.; *Migyaungnwè*, Burm.

A large climber. Stem furrowed. *Bark* greenish-grey, shining, with many lenticels both round short and long horizontal ones. *Wood* soft, in concentric layers alternately with and without pores. *Pores* large, often subdivided, in radial lines between the moderately broad *medullary rays*.

Central, Western and Southern India, common, extending north to the forests of Oudh, and north-east to Eastern Bengal; Chittagong; throughout Burma and the Andaman Islands; dry region of Ceylon.

A handsome climber of large size and white flowers on drooping branches.

C 4334. Pidthamamidi, Godavari Forests (Gamble).

2. D. robusta, Bth.; Fl. Br. Ind. ii. 241; Brandis For. Fl. 154; Kurz For. Fl. i. 338; Talbot Bomb. List 76. *Dalbergia Krowee*, Roxb. Fl. Ind. iii. 229. Vern. *Mowhitta, korai*, Ass.; *Bolkakarú*, Gáro; *Krowee*, Sylhet; *Gumbong*, Magh; *Tepukan*, Burm.

A deciduous tree. *Wood* light brown, hard. *Pores* large and moderate-sized, joined by narrow, wavy, concentric bands of soft texture. *Medullary rays* prominent, fine, wavy, equidistant.

Outer Himalaya from the Ganges eastwards, Assam, Eastern Bengal, Konkan, Burma.

Roxburgh says it grows quickly to a large size.

		lbs.
E 786.	Kamrúp, Assam (G. Mann)	53

3. D. uliginosa, Bth.; Fl. Br. Ind. ii. 241; Kurz For. Fl. i. 339; Talbot Bomb. List 76; Trimen Fl. Ceyl. ii. 92. Vern. *Kelia lota, kentia lota*, Beng.; *Kala-wél*, Cingh.

A large evergreen climbing shrub. *Bark* dark greyish-brown with many and prominent large horizontal lenticels. *Wood* brown,

in irregular masses of pore-bearing wood separated by broad anastomozing belts of bast tissue. *Pores* large, often subdivided, numerous. *Medullary rays* numerous, bent round the pores.

Coast forests of India, Burma and Ceylon.

The stems are twisted into ropes for tying logs to boats (Heinig, in Sund. Wg. Plan).

E 4862. Sundarbans, Bengal (Fordyce).

35. EUCHRESTA, Bennett. *E. Horsfieldii*, Bennett; Fl. Br. Ind. ii. 248, is an erect shrub of the Khasia Hills; also found, but rare, in Java.

TRIBE VIII. SOPHOREÆ.

36. DALHOUSIEA, Grah.

1. **D. bracteata,** Grah.; Fl. Br. Ind. ii. 248. *Podalyria bracteata*, Roxb. Fl. Ind. ii. 317. Vern. *Gopoori*, Sylhet.

A climbing shrub. *Bark* light brown, thin, fibrous. *Wood* soft, yellowish-white. *Pores* large or very large, very thick-walled. *Medullary rays* moderately broad to broad, numerous.

Lower Eastern Himalaya, Assam, Sylhet and Chittagong.

Khasia Hills—Kew Museum (J. D. Hooker).

37. SOPHORA, Linn.

Fourteen species of shrubs or small trees, three of which come from the West Himalaya, one from Baluchistan, one from Behar, one from the coast forests, one from Northern and Eastern Bengal, two from Upper Burma, three from South India and two from Ceylon. *S. tomentosa*, Linn.; Fl. Br. Ind. ii. 249; Roxb. Fl. Ind. ii. 316; Bedd. Fl. Sylv. lxxxix.; Trimen Fl. Ceyl. ii. 95; Kurz For. Fl. i. 335; Vern. *Thinbawmagyi*, Burm.; *Mudu-murunga*, Cingh., is a small tree of the sea-coast of Ceylon, Burma and the Andamans, perhaps extending to places in India, but rare. *S. Wightii*, Baker; Fl. Br. Ind. ii. 250; Talbot Bomb. List 76 (*S. heptaphylla*, Bedd. Fl. Sylv. lxxxix. *in part*), is a small tree of the hills of the Western Gháts, as the Nilgiris. *S. Bakeri*, C. B. Clarke, is a shrub found on Parasnáth Hill and elsewhere in Chota Nagpore. *S. Dunii*, Prain, and *S. Prazeri*, Prain, are shrubs of Upper Burma. *S. interrupta*, Bedd.; Fl. Br. Ind. ii. 251; Bedd. Fl. Sylv. xc.; Vern. *Adivi billu*, Tel., is a small pretty tree of the Kodúr Hills in Cuddapah, with a corky bark, rather resembling satinwood. *S. Griffithii*, Stocks, is a small shrub of Baluchistan.

1. **S. glauca,** Lesch.; Fl. Br. Ind. ii. 249; Bedd. Fl. Sylv. lxxxix.

A shrub. *Bark* brown, smooth. *Wood* white. *Pores* small, enclosed in pale tissue and irregularly arranged in groups and patches of 2 to 6, which become almost concentric in the outer edge of each annual ring. *Medullary rays* fine, white, wavy.

Hills of South India, very common on the Nilgiris, especially on the eastern side, at 5–6000 ft.

A very pretty and common shrub, with silky foliage and pink flowers.

W 3744. Coonoor, Nilgiris, 6000 ft. (Gamble).

2. **S. mollis,** Grah.; Fl. Br. Ind. ii. 251. *S. mollis*, Wall.; Brandis For. Fl. 132. Vern. *Arghawan*, Afgh.; *Gojár*, *ghwareja*, Trans-Indus; *Kún*, *kohen*, *málan*, Salt Range; *Tilún*, *tarni*, *kathi*, Chenab; *Brisari*, Ravi; *Pahar gúngri*, *khunmáni*, Kumaon; *Sakina*, Garhwal.

A shrub. *Bark* dark brown, studded with prominent pale lenticels. *Wood* hard, sapwood grey, heartwood brown. *Pores* small, enclosed

in pale tissue and joined into more or less concentric patches. *Medullary rays* fine, short.

West Himalaya from Kumaon westwards up to 6000 ft.

A conspicuous shrub with showy yellow flowers. It is apparently often gregarious, for Watt says that in the Ravi valley, about Barmour, 6500 ft., it is a low bush, covering large expanses on the hillsides (*Journ. Linn. Soc.* xviii. 380).

O 4840. Sahansdara, Dehra Dún, 3000 ft. (U. N. Kanjilal).

38. CALPURNIA, E. Meyer. *C. aurea*, Baker; Fl. Br. Ind. ii. 251; Bedd. Fl. Sylv. lxxxix., is a large shrub of the Denkinacottah Hills of the Salem District, and of Courtallum in Tinnevelly.

39. PERICOPSIS, Thw.

1. **P. Mooniana**, Thw.; Fl. Br. Ind. ii. 252; Bedd. Fl. Sylv. t. 187; Trimen Fl. Ceyl. ii. 97, t. 31. Vern. *Nédun*, Cingh.

A large tree. *Bark* smooth, pale brownish-pink on the trunk and flaking off in thin flat pieces, reddish-grey on the twigs (Trimen). *Wood* pale orange brown, streaked with darker hues, smooth, hard. *Pores* large, often subdivided into 2 or 3, in patches of loose tissue of big cells, which run together irregularly, but with a more or less concentric pattern on the whole. *Medullary rays* fine, pale, short, rather scanty.

Moist low country of Ceylon, up to 1000 ft., especially by river-banks.

A fine wood, in considerable demand, and much used for furniture (some of which looks very handsome), carts and other purposes. Mendis gives W = 56, P = 437.

Prof. Unwin's experiments with this wood gave the following results (*Imp. Inst. Jour.*, May, 1899):—

Weight	70·79 lbs. per cub. ft.	Judging by the weight compared with Broun's specimen, the one experimented with must have been exceptionally heavy or wet.
Resistance to shearing along the fibres	1486 „ sq. in.	
Crushing strength	3·919 tons per sq. in.	
Transverse strength	7·161 „ „	
Coefficient of elasticity	972·9 „ „	

	lbs.
4902. Ceylon (A. F. Broun)	about 43
No. 102, Ceylon Collection, new (Mendis)	56

40. ORMOSIA, Jacks.

Five species, all large trees. *O. robusta*, Wight; Fl. Br. Ind. ii. 252 (*Arillaria robusta*, Kurz For. Fl. i. 334); Vern. *Kywèdanyin*, Burm., is a large evergreen tree of the tropical forests of the Pegu Yoma and Upper Tenasserim, extending northwards to Sylhet. *O. travancorica*, Bedd. Fl. Sylv. t. 45; Fl. Br. Ind. ii. 253; Vern. *Mala manjádi*, Tam., Mal.; *Kuni*, Trav. Hills; *Kundhi*, Kader, is a large handsome tree of the hills of Travancore and Tinnevelly up to 3500 ft., extending northwards to the Ghâts of S. Kanara. Beddome says the timber "appears to be remarkably good, but at present is almost unknown." *O. inopinata* and *O. laxa*, Prain in Journ. As. Soc. Beng. lxix. ii. 2, 181, 182, are large trees of the Kachin Hills.

1. **O. glauca**, Wall.; Fl. Br. Ind. ii. 253; Gamble Darj. List 30. Vern. *Chuklein*, Lepcha.

A large tree. *Bark* grey. *Wood* greyish-white, moderately hard. *Pores* large, scanty, sometimes subdivided, surrounded by and joined by irregular, wavy, somewhat anastomozing patches of white, soft, open tissue. *Medullary rays* fine to moderately broad, wavy.

Lower hills of the Central Himalaya in Nepal and Sikkim up to 3000 ft.

This tree has a woody pod, with bright scarlet seeds, used by Lepchas as a bait to catch jungle fowl.

E 3356. Sivoke Hills, Darjeeling, 2500 ft. (Gamble).

E 3653, from a tree planted at Bamunpokri, Darjeeling Terai, by Mr. H. Leeds, about 1870, is *Castanospermum australe*, A. Cunn., the "Moreton Bay Chestnut," or "Black Bean." *Bark* grey. *Wood* hard, white with a yellowish tinge. *Pores* small, often subdivided, enclosed in patches of white soft tissue, which encloses them in twos and threes. *Medullary rays* fine, white, very numerous. The tree is grown in gardens in various parts of India—Madras, Calcutta, Dehra Dún, etc., and has a large pod with edible seeds somewhat like those of the Spanish Chestnut.

SUB-ORDER II. CÆSALPINIEÆ.

Contains 21 genera divided under 4 Tribes.

Tribe I.	Eucæsalpinieæ	Cæsalpinia, Peltophorum, Mezoneuron, Pterolobium, Poinciana, Parkinsonia, Wagatea, Hæmatoxylon.
„ II.	Cassieæ	Cassia, Cynometra, Dialium, Hardwickia, Crudia, Ceratonia.
„ III.	Amherstieæ	Saraca, Amherstia, Tamarindus, Humboldtia, Afzelia, Pahudia.
„ IV.	Bauhinieæ	Bauhinia.

Hæmatoxylon and *Ceratonia* are added here to the indigenous genera, as they contain trees which are cultivated and of importance, just as *Robinia* was added under *Papilionaceæ*. Besides the plant described, there are many others in cultivation in India. The various species of *Brownea*, with pendent heads of brilliantly coloured flowers, ornament gardens in Calcutta, Madras, Colombo, etc. *Colvillea racemosa*, Bojer, is a handsome tree, sometimes cultivated. It was introduced from Madagascar in 1840.

Like the *Papilionaceæ*, the *Cæsalpinieæ* have woods of, on the whole, a uniform structure, not very unlike that of those of the former sub-order. In some cases the concentric bands are very regular. The *pores* are always rather scanty, and usually fairly large.

TRIBE I. EUCÆSALPINIEÆ.

41. CÆSALPINIA, Linn.

Twelve species, erect or climbing shrubs or small trees, two being introduced plants. *C. Bonduc*, Roxb. Fl. Ind. ii. 362; Fl. Br. Ind. ii. 255; Brandis For. Fl. 156; Kurz For. Fl. i. 406; Vern. *Kalein*, Burm.; *Kumburu-wél*, Cingh., is a prickly climbing shrub of South India, Burma and Ceylon, closely allied to *C. Bonducella*, Fleming. *C. minax*, Hance, is a struggling shrub of the Shan Hills. *C. Nuga*, Ait.; Fl. Br. Ind. ii. 255; Brandis For. Fl. 157; Kurz For. Fl. i. 405; Talbot Bomb. List 77; Trimen Fl. Ceyl. ii. 99; Vern. *Natua, netu, shingri-lota*, Beng.; *Sugauk*, Burm.; *Diyawawuletiya*, Cingh., is a large scandent prickly shrub of coast forests, very common in the Andamans. *C. mimosoides*, Lam. is a prickly shrub resembling *C. sepiaria*, Roxb. *C. digyna*, Rottl.; Fl. Br. Ind. ii. 256; Kurz For. Fl. i. 407; Trimen Fl. Ceyl. ii. 100; Vern. *Sunletthè*, Burm., is a thorny climber chiefly common in Bengal, Chota Nagpore, the Circars and Burma, and on old village sites, waste land near villages and the banks of streams. Messrs. Cammiade Bros. of Madras reported to Mr. E. Thurston that the pods were said to yield a tan giving leather as white as snow. The pods of this species are apparently those known to the tanning trade as "*Tari*" or "*Teri*." Professor W. R. Dunstan, F.R.S., who analyzed them, found them to contain 50 per cent. of tanning matter, as against 30 per cent. yielded on an average by *C. Coriaria*. Altogether, it seems to be the most valuable tanning material known in India, but it remains to be seen whether the value is such as to induce those interested to undertake its cultivation.

This genus gives several important woods found in other parts of the world, such

as *C. crista*, L., the "Redwood" or "Brésillet;" *C. echinata*, Lam., the "Brasil wood" or "Pernambuco wood," and *C. braziliensis*, L., the "Braziletto" of S. America and the W. Indies.

Wood moderately hard, often with a red or orange-red heartwood. *Pores* moderate-sized, in patches. *Medullary rays* fine, numerous. Wavy concentric bands frequent in some species.

1. C. Bonducella, Roxb. Fl. Ind. ii. 357; Fl. Br. Ind. ii. 254; Brandis For. Fl. 156; Gamble Darj. List 30; Talbot Bomb. List 77. Vern. *Kat karanj, kat karinga, karanjo, karonj*, Hind.; *Kanjá*, Oudh; *Karbat, kachka*, Sind; *Yangkup*, Lepcha; *Nata*, Beng.; *Sagargota*, Mar.; *Gajkai*, Kan.; *Kat kareza*, Monghyr; *Bagni*, Sonthal.

A large prickly climbing shrub. *Bark* light brown. *Wood* white, hard. *Annual rings* distinct. *Pores* moderate-sized, single subdivided or in short radial strings, surrounded by a white ring, between the fine wavy white numerous *medullary rays* which are bent round them.

Throughout India, in hedges or climbing over bushes, usually near villages; but primarily a coast plant.

A useful hedge plant, covered with prickles and especially the pods. The seeds are large, grey, like marbles, used in medicine and to give an oil. Heinig says it is common on the outskirts of forests along the sea face of the Sundarbans, along river-banks and on clearings for cultivation.

	lbs.
O 4824. Thano, Dehra Dún (Gamble)	52

2. C. Sappan, Linn.; Fl. Br. Ind. ii. 255; Roxb. Fl. Ind. ii. 357; Bedd. Fl. Sylv. xc.; Brandis For. Fl. 156; Kurz For. Fl. i. 405; The Sappan-wood. Vern. *Bakam*, Hind., Guz., Beng.; *Patunga*, Tam.; *Bakamu, bakapu*, Tel.; *Bokmo*, Uriya; *Pattang*, Mar.; *Patanga*, Kan.; *Teinnyet*, Burm.; *Pattangi*, Cingh.

A small tree or straggling shrub. *Wood* hard: sapwood white; heartwood orange-yellow. *Pores* isolated, small, in narrow pale rings, scanty, between the fine, wavy, numerous *medullary rays*.

South India, Bengal and Burma, usually cultivated. I have never seen it wild, but Collett and Hemsley give it as wild in the Shan Hills.

The "Sappan-wood" tree, giving a valuable dye-wood, which used to be in considerable use and considerably exported, and is still used, but to a somewhat less extent. It gives a beautiful red colouring matter, soluble in water, used in wool-dyeing and calico-printing (Wardle, Watt Dict. ii. 11). Skinner gives (No. 33) W = 60 lbs. and P = 1540; Wallich gives 61 lbs. per cubic foot. It is a very pretty wood, takes a fine polish, and should be valuable for small work such as inlaying.

	lbs.
C 3136. Moharli, Central Provinces (sapwood)	52
W 4433. Malabar	—
O 4831. Dehra Dún (cult.)	52
No. 110, Ceylon Collection, new (Mendis)	46

3. C. sepiaria, Roxb. Fl. Ind. ii. 360; Fl. Br. Ind. ii. 256; Brandis For. Fl. 156; Kurz For. Fl. i. 406; Talbot Bomb. List 77; Trimen Fl. Ceyl. ii. 100. The Mysore Thorn. Vern. *Urn, úri, arlu, relu, kando, ail, aila*, Hind.; *Alai*, Dehra Dún; *Ari*, Jaunsar; *Karaunj*, Garhwal; *Chillari, chillúr*, Mar.; *Hotsigé*, Kan.; *Uchay*, Kól; *Gilo*, Uriya; *Kalein, sukyanbo*, Burm.

A straggling thorny shrub. *Bark* yellowish-white, corky, with corky excrescences bearing strong thorns. *Wood* light brown, moderately hard, with masses of reddish-brown harder wood near the centre. *Pores* large, often subdivided or in groups, surrounded and connected by anastomozing bands of pale tissue. *Medullary rays* fine, very numerous.

Throughout India from the lower Himalaya and Himalayan valleys southwards; low country of Ceylon; in hedges and open bushy places chiefly.

C 3460. Saranda Forests, Chota Nagpore (Gamble).

4. **C. pulcherrima,** Swartz; Fl. Br. Ind. ii. 255; Brandis For. Fl. 157; Kurz For. Fl. i. 407. *Poinciana pulcherrima*, Roxb. Fl. Ind. ii. 355. Vern. *Krishna chúra*, Beng.; *Daungzók*, Burm.

A shrub. *Bark* silvery-grey, studded with prominent but small lenticels. *Wood* hard: sapwood white; heartwood orange-yellow. *Pores* small, surrounded by pale tissue, single or in patches of a few together. *Medullary rays* very fine, numerous.

Commonly cultivated in Indian gardens, and often more or less run wild. Native country doubtful.

A handsome shrub, with flowers resembling those of the *Poinciana regia*, but much smaller.

O 4916. Saharanpur Bot. Garden (Gollan).

5. **C. Coriaria,** Willd.; Brandis For. Fl. 157. The "Divi-divi" or American Sumach.

A small erect tree, soon branching. *Bark* dark reddish-brown, thin, finely fissured vertically. *Wood* hard, heavy: sapwood greyish-white; heartwood nearly black, close-grained. *Pores* small, scanty, enclosed in pale tissue which spreads into concentric interrupted often anastomozing narrow bands. *Medullary rays* fine, white, narrow, regular and conspicuous. *Annual rings* distinct.

Introduced from the W. Indies, and cultivated especially in S. India, on account of its pods, which give a valuable tanning material, used for the same purposes as Sumach. Mr. E. Thurston reported the result of a correspondence with Messrs. Cammiade Bros. of Madras, who said, "Divi-divi is not procurable regularly, so it cannot be relied on. 'If it were grown more abundantly, and if the cultivators understood how to pick the 'pods at the right time when it is in prime condition, and if they sorted their Divi-divi 'and kept it from rot, this tannin would be valuable for cheap tannages. It is suitable 'for heavy hides, making very firm leather, but of a dark colour." The wood is hard and heavy, and likely to be useful for various purposes, so that if the demand for the tan is maintained, it should be a useful tree to plant on poor soils. Growth fairly fast, 6 rings per inch of radius.

	lbs.
C 4347. Mojagodo Plantation, Ganjam (Gamble)	74

42. PELTOPHORUM, Vogel.

1. **P. ferrugineum,** Benth.; Fl. Br. Ind. ii. 257; Kurz For. Fl. i. 408; Trimen Fl. Ceyl. ii. 101, t. 32. *Cæsalpinia inermis*, Roxb. Fl. Ind. ii. 367. Vern. *Iya-vakai*, Tam.

A large tree. *Bark* grey, smooth. *Wood* light reddish-brown, soft. *Pores* moderate-sized, often subdivided, scanty; enclosed, singly or in groups of twos and threes, in patches of loose tissue which often join together concentrically. *Medullary rays* very fine, very numerous, closely packed.

Andaman Islands and Malay Peninsula in coast forests; dry region of Ceylon.

A very fine tree, magnificent when in full flower, often planted.

Singapore—Kew Museum (Ridley, 1900).

43. MEZONEURUM, Desf.

About six species, all large woody thorny climbers of Eastern Bengal and Burma, the one given below alone extending to the rest of India.

1. **M. cucullatum,** W. and A.; Fl. Br. Ind. ii. 258; Brandis For. Fl. 155; Kurz For. Fl. i. 409; Gamble Darj. List 30; Talbot Bomb. List 78. *Cæsalpinia cucullata*, Roxb. Fl. Ind. ii. 358. Vern. *Biskoprah*, Oudh; *Ragi*, Bombay; *Sungray*, Nep.; *Runggong, yangkup*, Lepcha; *Kyaungchet*, Burm.

A large climbing shrub, very thorny. *Bark* brown, studded with corky tubercles, each bearing a pair of hooked thorns. *Wood* soft, very porous, with large *pores* and rather fine *medullary rays*.

Sub-Himalayan tract from the Sarda eastwards; Assam, Khasia Hills and Eastern Bengal; Behar and Chota Nagpore; Western Gháts of S. India.

E 488. Darjeeling Terai (Manson).

44. PTEROLOBIUM, R. Br.

Three species, large climbers, very prickly, with one-seeded samaroid pods. *P. macropterum*, Kurz For. Fl. 410; Vern. *Kyaungchet*, Burm., is the common Burma species, frequent along streams.

1. **P. indicum,** A. Rich.; Fl. Br. Ind. ii. 259. *Pterolobium lacerans*, Roxb. Fl. Ind. ii. 367.

A very thorny climbing shrub. *Bark* grey, thin, with conical excrescences ending in prickles. *Wood* white, soft. *Pores* moderate-sized surrounded by a ring of pale tissue, numerous. *Medullary rays* fine to moderately broad, white, numerous. *Annual rings* visible, 10 to 12 per inch of radius.

South India, common in hilly places in the Deccan down to the Nilgiris. Collected by Sir G. King in Dehra Dún, but I have never seen it there.

D 4150. Venketayapalem Forest, Kistna (Gamble).

45. POINCIANA, Linn.

One indigenous species, another introduced. Both very commonly planted as ornamental trees, the latter especially.

1. **P. elata,** Linn.; Fl. Br. Ind. ii. 260; Roxb. Fl. Ind. ii. 355; Bedd. Fl. Sylv. t. 178; Brandis For. Fl. 157; Talbot Bomb. List 78. Vern. *Sidhsaro*, Guz.; *Padenarayan*, Tam.; *Sunkeswar, sankesula*, Tel.; *Nirangi*, Kan.

A tree. *Wood* yellowish-white, sometimes with irregular red heartwood, soft. *Pores* large, scanty, irregularly distributed. Numerous light-coloured bands of loose tissue alternate with darker bands of more compact texture, but the pores, though more numerous in the former, are not always in that alone. *Medullary rays* short, fine, not numerous.

Porbunder State in Kathiawar, Bombay (Jaikrishna Inderji in Ind. For. xxvi. 17), apparently not really wild elsewhere. Roxburgh says, "Coromandel coast"; Brandis and Beddome, "forests of western and eastern coasts." I never saw it wild myself, certainly not on the Coromandel coast, which I know well, and Talbot only quotes Brandis. Gleadow (Ind. For. *l.c.*) says he never saw it wild in Bombay; and Bourdillon (Ind. For. xxvi. 170) says it is not found in Travancore.

A pretty tree. Very commonly planted in avenues and gardens in S. India, very handsome when in flower, and very ornamental. Skinner, No. 106, says it has wood of a yellow colour, tolerably close and even-grained, easily worked, and giving a smooth surface, warping slightly, but not subject to crack, well suited for cabinet work. He gives W = 45 lbs., P = 516.

It grows well from cuttings, and has been used in Madras to protect the footings of rivers, and to protect channel banks (Balfour, "Timber Trees"). The branches and leaves are cut and used as manure for indigo fields. Jaikrishna Inderji, in his paper above quoted, says that it grows all over the Bardé Hills in Porbunder, especially in

crevices of the basalt and trap rocks, but is stunted, knotty, and branching. He reports that the wood is used for churns, bedstead-legs, combs and matches; that the root is useful to remove the pain of scorpion-bite, and that the leaves and flowers are used in medicine.

		lbs.
C 4842.	Porbunder Forests, Kathiawar (Jaikrishna Inderji)	43

Nordlinger's Sections, vol. 11.

2. **P. regia,** Bojer; Brandis For. Fl. 157; Kurz For. Fl. i. 404; Talbot Bomb. List 78. The "Gold Mohur or 'Gulmohr' tree" or "Flamboyant." Vern. *Shima sankesula*, Tel.

An evergreen handsome tree. *Bark* brown, slightly rough. *Wood* white, soft. *Pores* large, often subdivided or in pairs, surrounded by patches of loose pale tissue, which are sometimes confluent. *Medullary rays* fine to moderately broad, rather scanty, showing as a silver-grain on a radial section. *Pores* very prominent on vertical sections.

Native of Madagascar, planted in gardens and avenues in all the warmer and damper parts of India.

A gorgeous tree when in flower, with its large corymbs of crimson flowers and bright green leaves; grows very quickly.

		lbs.
E 4558.	Sibpur Engineering College Garden (Slater)	28

46. PARKINSONIA, Linn.

1. **P. aculeata,** Linn.; Fl. Br. Ind. ii. 260; Brandis For. Fl. 158; Bedd. Fl. Sylv. xci.; Kurz For. Fl. i. 403; Talbot Bomb. List 78. Vern. *Vilayati kikar*, Pb.; *Tairi*, Monghyr; *Sima tumma*, Tel.

A small tree. *Bark* brown, very thin, with numerous horizontal narrow lenticels usually about ¼ in. long. *Wood* white with an irregular purplish-brown heartwood, hard. *Pores* moderate-sized or even small to large, often subdivided, surrounded either singly or in groups by patches of pale loose tissue, the patches more or less concentric in arrangement. *Medullary rays* fine to moderately broad, not numerous, rather short.

An introduced plant, completely naturalized in all the dry regions of India, especially in the Punjab and the Deccan.

A handsome little tree with showy yellow flowers and narrow constricted pods. It is often used for hedges. It grows in all dry regions and even on black cotton soil.

		lbs.
P 4848.	Punjab (C. F. Elliott)	52

Nordlinger's Section, vol. 8, is rather doubtful, as the pores are *not* surrounded by loose tissue, as is usual in the Family.

47. WAGATEA, Dalz. *W. spicata*, Dalz.; Fl. Br. Ind. ii. 261; Talbot Bomb. List 78; Vern. *Wagati*, Mar., is a prickly climbing shrub of the Western Coast forests.

48. HÆMATOXYLON, Linn.

1. **H. campechianum,** Linn. "Logwood."

A small tree with much buttressed and indented trunk. *Bark* dark brown, exfoliating in small plates. *Wood* hard: sapwood small, white; heartwood bright red. *Pores* moderate-sized, small, often subdivided, surrounded by narrow patches of pale tissue which spreads into concentric anastomozing bands. *Medullary rays* fine, numerous.

Introduced from the W. Indies, and often cultivated in gardens. The wood is a

very valuable dye-wood, and largely imported into Europe from America. It gives a deep red, violet, or black dye.

		lbs.
O 4559, 4571.	Saharanpur Bot. Garden (Gollan) . . .	61 and 67

Tribe II. CASSIEÆ.

49. CASSIA, Linn.

About 13 species, of which three are introduced shrubs. Six species only grow into trees, while four are small trees or shrubs. They all have showy flowers, usually bright yellow.

C. renigera, Wall.; Fl. Br. Ind. ii. 262; Kurz For. Fl. i. 392; Vern. *Ngushwe*, Burm., is a tree of the forests of the Shan Hills and the dry forests of Prome. Prain mentions that all the Shan Hills specimens have yellow flowers, while in those from Pegu the flowers are pink. *C. alata*, Linn.; Fl. Br. Ind. ii. 264; Talbot Bomb. List 79 (*Senna alata*, Roxb. Fl. Ind. ii. 349); Vern. *Dadmurdan*, Hind., Beng.; *Wandu rolli*, Tam.; *Mitta tamara*, Tel.; *Mezaligyi*, Burm., is a handsome small tree introduced from the W. Indies and now found cultivated or run wild in various parts of India. It has large leaves and large bracteate racemes of flowers. *C. glauca*, Lam.; Fl. Br. Ind. ii. 265; Bedd. Fl. Sylv. xci.; Kurz For. Fl. i. 394; Talbot Bomb. List 79 (*Senna arborescens*, Roxb. Fl. Ind. ii. 345), is a shrub, wild in the forests of Western and South India and Burma, elsewhere much planted and noticeable for its profusion of flowers of a pale yellow.

C. bicapsularis, Linn., *C. tomentosa*, Linn. and *C. lævigata*, Willd. are all handsome-flowered shrubs which have been introduced and cultivated and eventually run wild in hill regions and especially on the Nilgiris and in the Khasia Hills.

C. occidentalis, Linn.; *C. Sophera*, Linn.; and *C. Tora*, Linn. are common weeds of roadsides, river-banks and fallow lands in most parts of India, the last-named having long narrow pods with angular seeds, known as *Kuwari*, which are used in tanning and in medicine, all three are used in skin-diseases (Agr. Ledger, 1896, No. 29).

Wood hard, heavy; heartwood dark-coloured. *Pores* moderate-sized and large, in patches of soft texture, which in some species are confluent and form more or less continuous concentric bands or elongated patches.

1. **C. Fistula,** Linn.; Fl. Br. Ind. ii. 261; Roxb. Fl. Ind. ii. 333; Bedd. Fl. Sylv. xci.; Brandis For. Fl. 194; Kurz For. Fl. i. 391; Gamble Darj. List 30; Talbot Bomb. List 79; Trimen Fl. Ceyl. ii. 103. *Cathartocarpus Fistula*, Pers. The Indian Laburnum. Vern. *Amaltas*, Hind.; *Kinjál*, *krinjal*, Kashmir; *Alash*, *ali*, *karanzai*, *karangal*, *kiár*, *kaniár*, Pb.; *Királa*, Dehra Dún; *Sinára*, Garhwal; *Raj briksh*, *kitola*, Kumaon; *Chimkani*, Sind; *Gurmala*, Guz.; *Sundali*, *bandarlati*, Beng.; *Shongrál*, Sundarbans; *Sandari*, *sunari*, Uriya; *Kitwáli*, *kitoli*, *itola*, *shimarra*, *sim*, North-Western Provinces; *Warga*, *urga*, Oudh; *Jaggarwah*, *raila*, *hirojah*, *karkacha*, C.P.; *Jaggra*, *jagarua*, *kambar*, *rera*, Gondi; *Hari*, Kól; *Dunrás*, Kharwar; *Raella*, Baigas; *Kirmalia*, Merwara; *Pundali*, Khond; *Rela*, Reddi; *Banag*, *bangru*, Kurku; *Bahawa*, *boya*, *bawa*, Mar.; *Raj biri*, Nep.; *Sungyen*, Lepcha; *Sonalu*, Gáro; *Bonurlati*, *bonurlauri*, *persar*, Palamow; *Sunaru*, Assam; *Bandolat*, Cachar; *Kone*, *sirikone*, *tirukontai*, *kavani*, Tam.; *Reylu*, *rela*, *suvarnam*, *konay*, Tel.; *Konnei*, Mal.; *Kaki*, Tam.; *Kakke*, Kan.; *Ehéla*, Cingh.; *Ngu*, *ngugyi*, Burm.

A moderate-sized deciduous tree. *Bark* ¼ in. thick, compact, greenish-grey and smooth when young, dark-reddish brown and rough when old, exfoliating in many-sided patches. *Wood* very hard: sapwood large; heartwood varying in colour from grey or yellowish-red to brick-red, darkens much on exposure. *Pores* moderate-sized to large, often subdivided, often filled with resin, scanty, uniformly distributed, enclosed in, and joined by, white, wavy, irregular, often interrupted, often anastomozing concentric bands of soft tissue.

Medullary rays very fine, numerous, uniform, slightly bent, prominent in the dark, firm tissue which separates the wavy bands.

Throughout the forests of India, Burma and Ceylon, one of the most widespread of Indian trees; ascending to 4000 ft. in the Himalaya and extending north to the hills above Peshawur; usually in deciduous forest.

A beautiful tree, very conspicuous both when bearing its long pendulous racemes of bright yellow flowers and when carrying its long stick-like cylindrical pods. It is not gregarious, but occurs fairly uniformly scattered in places suited to its growth. It is easily propagated and frequently planted in gardens and avenues, and its flowers are used in religious ceremonies by Hindus.

The timber is good and durable, but of small size and difficult to work, brittle and apt to splinter. It is excellent for posts and good for carts, agricultural implements and rice-pounders, also for bows and for boat spars. Graham Anderson recommends it for bedplates for machinery. The growth is moderate only, about 9 rings per inch of radius.

The weight and transverse strength have been determined by the following experiments:—

Experiment by whom made.	Years.	Wood whence produced.	Weight.	No. of experiments.	Size of bar.	Value of P.
			lbs.		ft. in. in.	
Kyd	—	Assam	56	—	2 × 1 × 1	588
Skinner, No. 43	1862	South India	61	—	—	846
R. Thompson	1868	Central Provinces	52	—	—	—
Brandis, Nos. 33 and 34	1862	Burma	{ 57 66 }	—	—	—
Central Provinces List.	1873	Central Provinces	66	—		—
Specimens examined	1878–99	Various	61	13	—	—

The pulp of the pods is a strong purgative, but it is eaten by bears and monkeys, apparently with impunity. The bark is largely used for tanning, but is apt to darken the leather too much. In the North-West Provinces it is considerably in demand for the Cawnpore tanneries, and in South India the demand for permits to collect the bark has sometimes caused a good deal of damage to and waste in the forests. The stem gives a gum, but little used. Both flowers and leaves are said to be occasionally eaten, though rejected by cattle and goats, and the pulp of the fruit is employed to flavour native tobacco. The wood is an excellent fuel, and gives good charcoal of bright colour and good ring.

The seeds in the pods are frequently destroyed by the Tortricid moth *Cryptophebia Carpophaga*, Wlsm. (see "Ind. Mus. Notes," iv. 106).

			lbs.
P	101.	Sutlej Valley, Punjab, 3000 ft.	—
P	437, 439.	Ajmere	61
O	244.	Garhwal (1868)	52
O	333.	Gorakhpur (1868)	52
C	1154.	Ahiri Reserve, Central Provinces (R. Thompson)	56
C	3544.	Khurdha Forests, Orissa (Gamble)	58
E	579.	Lohagarhi Forest, Darjeeling Terai (Manson)	62
E	2352.	Bamunpokri, Darjeeling Terai (Gamble)	62
E	783.	Kamrúp, Assam (G. Mann)	60
W	864.	South Kanara (Cherry)	62
D	2052.	Mysore (Kurz)	58
D	1076.	North Arcot, Madras (Beddome)	73
D	4018.	Collegal, Coimbatore	65
B	2525.	Burma (Brandis, 1862, No. 33)	66

No. 29, Ceylon Collection, new (Mendis).

Nordlinger's Sections, vol. 8 (Tab. VI. 3).

2. C. nodosa, Ham.; Roxb. Fl. Ind. ii. 336; Fl. Br. Ind. ii. 261; Kurz For. Fl. i. 392. Vern. *Nguthein*, Burm.

A large evergreen tree. *Bark* yellowish-brown, smooth when young, with numerous narrow but deep horizontal clefts. *Wood* moderately hard: sapwood light brown; heartwood red. *Pores* moderate-sized or large, scanty, scattered, surrounded by large rings of loose tissue. *Medullary rays* numerous, fine, regular.

Forests of Chittagong; evergreen tropical forests of Burma, north to Myitkyina; Andamans.

	lbs.
B 5078. Minbu Division, Burma (Calthrop)	40

Nos. B 2260, 2295 (Col. Ford, Andamans); Vern. *Gnoogyee* may belong to this species.

3. C. marginata, Roxb. Fl. Ind. ii. 338; Fl. Br. Ind. ii. 262. *C. Roxburghii*, DC; Bedd. Fl. Sylv. t. 180; Trimen Fl. Ceyl. ii. 104. Vern. *Urimidi, uskiamen*, Tel.; *Vakai*, Tam.; *Ngoomee*, Burm.; *Ratu-wa*, Cingh.

A small deciduous tree. *Bark* deeply cracked, brown. *Wood* light brown, very hard. *Pores* moderate-sized and large, joined by narrow, undulating, irregular, pale or dark (when cells are filled with resin) bands of soft tissue, which are much narrower and of smaller cells than in *C. Fistula*. *Medullary rays* fine and very numerous, uniform and equidistant, prominent in the dark firm tissue which separates the bands.

S. Arcot, Tanjore, Trichinopoly and Tinnevelly Districts of Madras (Beddome); dry region of Ceylon; largely planted in other parts as an ornamental tree. Thaungyeen forests of Burma (Brandis).

A pretty tree with rose-coloured flowers. The wood is strong and durable, "well 'adapted for articles of turnery, such as naves of wheels and handles of instruments" (Beddome). Skinner, No. 44, gives W = 63 lbs., Beddome says 75 to 80 lbs., one specimen only gives 59 lbs.

	lbs.
B 301. Burma (Brandis, No. 35, 1862)	59
Nordlinger's Sections, vol. 5.	

4. C. auriculata, Linn.; Fl. Br. Ind. ii. 263; Brandis For. Fl. 165; Talbot Bomb. List 79; Trimen Fl. Ceyl. ii. 106. *Senna auriculata*, Roxb. Fl. Ind. ii. 349. Vern. *Tarwar, awal*, Hind.; *Tarota, tarwas*, Berar; *Avaram, avarai*, Tam.; *Awal*, Merwara; *Tangedu, tangar*, Tel.; *Turwar, arsúl*, Mar.; *Ranawara*, Cingh.; *Peikthingat*, Yaw (Burma).

A shrub. *Bark* thin, smooth, grey with reddish-brown lenticels irregularly scattered, sometimes horizontally, sometimes vertically arranged. *Wood* brown, hard. *Pores* small, scanty, in pale irregular patches, joined into wavy concentric bands. *Medullary rays* fine, regular, bent where they touch the pores.

Central and South India, extending northwards to Rajputana and perhaps to Jhansi, common on dry stony hills and on black cotton soil; Shan Hills of Burma at 3000 ft.

A very valuable shrub, whether for its use in reclothing barren tracts of land where little else will grow, or for its bark, which is one of the most valuable tans in India, and one of the chief of the *catechol* varieties. In a Report on leathers for bookbinding made to the Society of Arts (*Journal*, July 5, 1901) it is stated that "many thousands 'of skins come over from India, tanned with *tarwar* bark. These are brought on the 'London market by the leather-dressers, and are usually detannized by scouring or by 'drumming in an alkaline solution, next treated with sulphuric acid to brighten their 'colour, and retanned in sumach, after which they are finished, and are usually sold 'under the name of 'Persian morocco' or 'Persian sheep.'" They were not considered very good for bookbinding. Messrs. Cammiade Bros. of Madras reported that it gave a very fair colour, which, however, soon changed to a murky brown. They seemed to consider it excellent for heavy hides for which colour was not very important, but complained that its cost in Madras (25 lbs. per R.1) was too heavy. Analysis made by Mr. D. Hooper with Mysore bark gave as follows:—

	Young bark.	Old bark.
Tannin	11·92 .	. 20·12
Insoluble tannin (phlobaphene)	2·30 .	. 4·90
Watery extract	22·35 .	. 29·00
Ash and moisture	11·41 .	. 14·20

The harvesting and sale of "tangedu" or "avaram" bark is a most important forest industry in S. India, and requires careful regulation. The first crop is usually obtained when the shrub is five years old, and it costs about Rs.9 to collect 1000 lbs. of bark (F. Lodge). It seems that a rotation of about three years is found the best regular treatment. The shrub is easily cultivated, and ought to be largely so, to reclothe poor lands and prepare them for more valuable tree growth. It was successfully grown on poor land about Rajampet in Cuddapah. The seeds, leaves and flowers are used in native medicine, and the leaves are largely cut and used for ploughing into rice-fields, being considered an excellent manure.

C 3919. Bhadrachalam, Upper Godavari (Gamble).
D 4253. Kothapatam, Nellore (Gamble).

5. **C. siamea,** Lamk.; Fl. Br. Ind. ii. 264; Kurz For. Fl. i. 392; Talbot Bomb. List 79; Trimen Fl. Ceyl. ii. 108. *C. florida*, Vahl; Bedd. Fl. Sylv. t. 179. *Senna sumatrana*, Roxb. Fl. Ind. ii. 347. Vern. *Beati, manje konne, vakai*, Tam.; *Kassod*, Mar.; *Mèzali*, Burm.; *Wa, aramana*, Cingh.

A moderate-sized tree. *Bark* grey, smooth, slightly fissured longitudinally. *Wood* hard: sapwood whitish, rather large; heartwood dark brown to nearly black, in stripes of dark and light. *Pores* large and moderate-sized, scanty, embedded in pale, nearly continuous, broad, wavy bands of soft texture, which alternate with very hard, almost black bands of very close texture. *Medullary rays* fine, scanty, irregular. On a radial section the wood is streaked light and dark, on a tangential section the dark patches appear as zigzag plates, and this is the section which would be most handsome in joinery work.

"Common in the jungles quite at the south of the Madras Presidency" (Beddome); mixed and dry forests of Burma from Chittagong down; low country of Ceylon up to 2000 ft.; largely planted in suitable places all over India.

A handsome tree, very commonly used for avenues and also planted in gardens, topes, etc. It grows quickly, and is very easy to propagate. The flowers are bright yellow. The pretty wood is not usually of large enough dimensions for extended employ. Kurz says that in Burma it is used for helves, walking-sticks and mallets; Beddome that it is the chief fuel used in Ceylon for locomotives. It clearly deserves to be better known and more used for furniture, inlaying, etc.

Skinner, No. 39, gives W = 58 lbs., Brandis and Beddome 58 lbs., the specimens give an average of about 50 lbs.; perhaps 54 would be the better average. Skinner gives P = 840.

		lbs.
E 3710.	Royal Bot. Garden, Calcutta (King)	45
D 1080.	North Arcot (Beddome)	58
D 3893.	Agri-Hortl. Gardens, Madras (Steavenson)	43 (sapwood)
B 2526.	Burma (Brandis, No. 35, 1862)	54
B 2712.	Tavoy (Wallich, 1828)	52

No. 141, Ceylon Collection, new (Mendis).

6. **C. timoriensis,** DC; Fl. Br. Ind. ii. 265; Bedd. Fl. Sylv. xcii.; Kurz For. Fl. i. 393; Talbot Bomb. List 79; Fl. Ceyl. 108. Vern. *Taungmèzali*, Burm.; *Arremene*, Cingh.

A handsome small evergreen tree. *Wood* dark brown, nearly black, in structure the same as *C. siamea*.

Hills of the Western Ghâts and low country of Ceylon.

Mendis gives W = 57 lbs., P = 594, and says the wood is used in Ceylon for building and furniture.

	lbs.
No. 4, Ceylon Collection, old; No. 6, new (Mendis)	57

7. C. montana, Heyne; Fl. Br. Ind. ii. 264; Bedd. Fl. Sylv. xcii.; Talbot Bomb. List 79. Vern. *Konda tangedu*, Tel.

A large shrub. *Bark* dark grey, smooth, with small lenticels arranged in horizontal lines. *Wood* yellowish-brown, hard, the annual rings prominent. *Pores* small or moderate-sized, single or subdivided, or in groups of 2 to 3 in patches of, and joined occasionally only by, light-coloured soft tissue. *Medullary rays* fine, short.

Southern and Western India, especially in the South Deccan and Carnatic, in similar places to *C. auriculata*, but not on black cotton soil.

A pretty shrub of bright yellow flowers, likely to be useful to reclothe dry, rocky, denuded areas, but not so valuable as *C. auriculata*.

	lbs.
D 3966. Cuddapah District (Gamble)	62

50. CYNOMETRA, Linn.

Four Indian species wild, and one species, *C. cauliflora*, Linn., cultivated in gardens. *C. travancorica*, Bedd. Fl. Sylv. t. 316; Fl. Br. Ind. ii. 267, is a large, handsome tree of the evergreen forests of Tinnevelly and Travancore, at 2–4000 ft., especially near Courtallum. *C. Beddomei*, Prain in Journ. As. Soc. Beng. lxvi. ii. 478, is a tree of the Ghâts of S. Kanara and of the Wynaad.

1. C. ramiflora, Linn.; Fl. Br. Ind. ii. 267; Bedd. Fl. Sylv. t. 315; Kurz For. Fl. i. 415; Talbot Bomb. List 80; Trimen Fl. Ceyl. ii. 111. Vern. *Shingra, shingar*, Beng.; *Irapú*, Tam.; *Myinkabin*, Burm.; *Gal mendora*, Cingh.

A large evergreen tree. *Bark* smooth, brownish-grey. *Wood* red, hard, close-grained. *Pores* small, often oval and subdivided, in patches of loose texture joined by pale, soft, wavy bands, which alternate with narrower bands of firm tissue. *Medullary rays* fine, very numerous.

Sea coast tidal forests of the Sundarbans, S. India, Burma, the Andamans and Ceylon; often cultivated in gardens.

This is sub-sp. *bijuga*, var. *mimosoides* (Prain). Skinner, No. 52, gives W = 56 lbs., P = 826. Nos. 27, 32 of A. Mendis' Ceylon Collection bear the names "*Gal mendora*" and "*Hal mendora*," W = 56 to 58 lbs., P = 740. Skinner says the wood is used for house- and cart-building, and that chips of the wood give a purple dye in water. In the Sundarbans it is used for posts for native huts and for fuel. Heinig says that its shade is too heavy for Sundri seedlings, which do not thrive beneath it.

	lbs.
E 397. Sundarbans (Richardson)	58

C. polyandra, Roxb. Fl. Ind. ii. 372; Fl. Br. Ind. ii. 268. Vern. *Ping*, Cachar, Sylhet.

A large evergreen tree. *Wood* light red, hard, close-grained. *Pores* moderate-sized, joined by narrow concentric bands of loose tissue. *Medullary rays* moderately broad.

Khasia Hills, Sylhet and Cachar.

Wallich gives the weight 53 lbs. per cubic foot; the specimen gives 60 lbs. Mann says the wood is useful for building, and is good for charcoal.

	lbs.
E 1276. Cachar (G. Mann)	60

51. DIALIUM, Linn.

1. D. ovoideum, Thw.; Fl. Br. Ind. ii. 269; Bedd. Fl. Sylv. t. 181; Trimen Fl. Ceyl. ii. 112. Vern. *Kaddupuli*, Tam.; *Gal-siyambala*, Cingh.

A tall tree. *Bark* smooth. *Wood* dark red-purple, nearly black, very hard, close-grained. *Pores* moderate-sized, ringed, scanty, resinous, prominent on a vertical section. *Medullary rays* extremely fine,

but distinct, very regular and numerous, the distance between them much less than the diameter of the ringed pores.

Low country of Ceylon, scarce.

A fine wood which deserves to be better known. The tree might be worth cultivation. Mendis says the wood is used for oil-presses, cog-wheels, furniture and building. The fruit, known as "wild tamarind," is edible.

	lbs.
No. 37, Ceylon Collection, new (Mendis)	82

2. D. coromandelianum, Houtt. (?). Vern. *Malam puli*, Tam.

A tall tree. *Wood* grey, moderately hard. *Pores* large, scanty and sparsely distributed, joined by wavy concentric light bands of loose tissue. *Medullary rays* very fine, numerous.

Forests of Travancore.

	lbs.
W 4683. Travancore (Bourdillon)	58

The specific name here adopted has been (doubtfully) inserted as a guess after reading Prain's remarks in Journ. As. Soc. Beng. lxvi. ii. 483, in which he says his specimens came from Mr. Lawson. Lawson may have received his specimens from Bourdillon.

52. HARDWICKIA, Roxb.

Two species, both of South India.

1. H. binata, Roxb. Fl. Ind. ii. 423; Fl. Br. Ind. ii. 270; Bedd. Fl. Sylv. t. 26; Brandis For. Fl. 162; Talbot Bomb. List 80. Vern. *Anjan*, Hind., Mar.; *Acha, alti*, Tam.; *Yepi, nar yepi, yapa*, Tel.; *Kamrá, karachi*, Kan.; *Chhota dundhera*, Gondi; *Bone*, Kurku; *Parsíd*, Singrowli.

A deciduous tree. *Bark* ½ in. thick, dark grey, rough with irregular vertical cracks, exfoliates in narrow flakes. *Wood* extremely hard: sapwood small, white; heartwood dark red streaked with black, often with a purplish tinge, cross- and very close-grained. *Pores* moderate-sized, often subdivided, filled with resin, uniformly distributed. *Medullary rays* fine, numerous, undulating, bent where they touch the pores, visible on a radial section as fine plates giving a pretty silver-grain. Occasional scanty, fine, concentric lines.

Dry forests of South India, rather local, extending northwards as far as the Banda district of the North-Western Provinces; generally gregarious in isolated belts or patches of greater or less extent; usually on sandstone, but also on trap-rocks and gneiss. Brandis says, "In Central India, the tree is known in Chanda, Berar, 'Khandésh and Nimar, on the eastern slopes of the Pachmarhis, near the Dhúdi river, 'and on the Singrowli hills, south of the Sône river." In South India its chief localities are: in Godavari in the forests round Bhadráchalam, in Kistna in the great Bollapalli reserve and adjoining forests, in Anantapur in the Muchukota forest, in Bellary at Malpangudi, besides other places in Cuddapah, Kurnool, etc., where it occurs mixed with other trees; further south it is found on "both banks of the 'Cauvery in Salem District and on the Balarangams, at Hasanúr and Gazalhati, in 'Coimbatore (Beddome)." Talbot mentions a small forest at Ranibenúr in Dharwar District. It is found also in tropical Africa.

A beautiful, very graceful tree, growing to a large size, but large trees are now scarce, partly owing to the demand for the wood, partly to the custom of pollarding the tree for its branches whose bark yields a fibre universally used for well-ropes and other agricultural purposes; and partly to its leaves being used for manure and for cattle-fodder. Its reproduction is good; it gives a profusion of seed, and the seedlings spring up quickly, but, like those of Teak, Sál, and other Indian trees, are killed to the ground-level year after year in the season of hot winds, until finally the roots get far down into moist strata and the shoots are strong and big enough to grow on into trees. The saplings, however, never seem to grow thickly, but to prefer to be separated for

some distance, even when there are no, or few, other species of tree in the interval. It also coppices well.

Weight, according to Skinner, No. 78, 85 lbs.; R. Thompson gives 67; and the Central Provinces List of 1873, 65 lbs.; specimens examined give an average of 82 lbs. Skinner gives P = 942. Perhaps the hardest and heaviest wood in India; it is extremely durable, liable to split, but does not warp. It is used for bridge and house posts and for ornamental work. It has been recommended for sleepers, but is probably too hard, heavy and difficult to work to be much in favour. Out of 9 sleepers laid down on the Mysore State Railway and taken up after 7 to 8 years, 6 were found good, 2 still serviceable, and only 1 bad. About 2000 have been used on the Holkar and Neemuch line. At the Dehri workshops on the Sône river it has been used for bearings for machinery and found to wear well. Sleepers buried at the Forest School for experiment, when dug up in 1893, after 7 years in the ground, were found still perfectly sound in all respects. The wood is valued for naves for cart-wheels, and for ploughshares used on black cotton soil. The rate of growth is rather slow, usually about 10 rings per inch of radius. It is noticeable that the wood of the Upper Godavari specimen is lighter in colour and of less weight than the others. A. W. Lushington says that planted trees of known age on the Kistna canals gave 2·04, 3·23, 4·54, 6·10, 7·35, 8·43, 9·43, 10·39, 11·33, 12·26, 13·18 in. diameter for 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55 years' growth respectively. The last corresponds to about 8 rings per inch.

As already noticed, *Anjan* is much pollarded both for fodder and manure, as well as for the fibre given by the branches.

		lbs.
C 800.	Punassa Reserve, Central Provinces (Doveton)	84
C 1147.	Ahiri „ „ „ (R. Thompson)	84
C 2986.	Nimar, Central Provinces (Brandis)	83
C 2929.	Palamow, Bengal	82
C 4061.	Bhadrachalam, Upper Godavari (Gamble)	60
D 1055.	Salem, Madras (Beddome)	83
D 2025.	Mysore (Kurz)	77
D 3929.	Muchukota Reserve, Anantapur (young tree)	57
D 4020.	Collegal, Coimbatore	82
D 4187.	Bollapalli Forest, Kistna	—
No. 31, Salem Collection		82
	Nordlinger's Sections, vol. 11.	

2. H. pinnata, Roxb. Fl. Ind. ii. 425; Fl. Br. Ind. ii. 270; Bedd. Fl. Sylv. t. 255. Vern. *Kolávu*, Tinnevelly; *Matáyen samprâni*, Travancore; *Yenne*, Manjarabad; *Shuráli, kolla*, Mal.; *Uram*, Trav. Hills.

A very large tree. *Wood* moderately hard: sapwood large; heartwood dark red or reddish-brown, exuding a red, sticky resin. *Pores* moderate-sized and large, often subdivided, scanty. *Medullary rays* fine, nearly equi-distant, bending where they touch the pores. Scanty, not very prominent, concentric lines of soft texture.

Western Ghâts from South Kanara to Travancore.

Weight, 47 lbs. per cubic foot. Bourdillon gives W = 46, P = 640. The wood is used for building by coffee-planters and others. For analysis of the gum resin see Mr. Broughton's Report in Beddome Fl. Sylv. t. 255. The tree yields also a valuable balsam, like copaiba (Beddome).

		lbs.
D 1064.	Tinnevelly (Beddome)	47
W 4296.	„ (Brasier)	44
W. 4620.	Travancore (Bourdillon)	45

53. CRUDIA, Schreb. *C. zeylanica*, Benth.; Fl. Br. Ind. ii. 271; Bedd. Fl. Sylv. t. 190; Trimen Fl. Ceyl. ii. 113, is a large tree endemic in Ceylon, in the moist low country, and apparently very rare.

54. CERATONIA, Linn.

1. C. siliqua, Linn.; Brandis For. Fl. 166. The "Carob tree," or "Locust tree."

A small tree. *Wood* hard, sapwood white, heartwood red. *Pores*

moderate-sized, much subdivided in radial patches of 3 to 6 subdivisions. *Medullary rays* narrow, unequal, irregularly distributed.

Indigenous in South Europe and North Africa; to some extent naturalized in the Punjab and other regions in India.

The tree produces a quantity of edible pods which are used for food, and are often given to cattle, horses, pigs, etc. It is not very easy to grow; it requires a special climate, and is liable to damage by frost. The attempts to naturalize it in India, though persistent and occasionally promising, have not on the whole succeeded very well.

	lbs.
O 3266, 4560. Saharanpur Bot. Garden (Duthie, Gollan) . . .	51
Nordlinger's Sections, vol. 7.	

TRIBE III. AMHERSTIEÆ.

55. SARACA, Linn.

About five species. *S. Zollingeriana*, Miq. and *S. Lobbiana*, Baker, are small trees of Martaban. *S. triandra*, Baker; Fl. Br. Ind. ii. 272, is found in Tenasserim, and *S. Griffithiana*, Prain, in Upper Burma.

1. **S. indica,** Linn.; Fl. Br. Ind. ii. 271; Bedd. Fl. Sylv. t. 57; Brandis For. Fl. 166; Kurz For. Fl. i. 415; Talbot Bomb. List 80; Trimen Fl. Ceyl. ii. 114. *Jonesia Asoca*, Roxb. Fl. Ind. ii. 218. The Asoca tree. Vern. *Asok*, Hind.; *Asoka*, Beng.; *Ashok, jassundi*, Bombay: *Aseka, oshoko, ati*, Uriya; *Ashunkar*, Kan.; *Thawgabo*, Burm.; *Diya-ratmal*, Cingh.

A small tree. *Wood* light reddish-brown, soft; occasional faint brown concentric belts of soft tissue. *Pores* moderate-sized, in radial and frequently oblique lines. *Medullary rays* fine, scanty, indistinct.

Eastern Bengal to Chittagong and Arracan; forests of the Northern Circars and Orissa; evergreen forests of the Konkan and N. Kanara; low country of Ceylon; usually along streams; much cultivated in gardens.

This tree, "the 'Sorrowless tree' or 'Heart's-ease' of the Mahabharata" (Edwin Arnold), is one of the most important sacred trees in India, both among Hindus and Buddhists, and the handsome orange-red flowers are used in temple decoration.

	lbs.
E 4896. Bengal (Orissa?)	36
No. 23, Ceylon Collection, old; No. 25, new (Mendis)	58

56. AMHERSTIA, Wall.

1. **A. nobilis,** Wall.; Fl. Br. Ind. ii. 272; Kurz For. Fl. i. 411. Vern. *Thawgu*, Burm.

A small tree. *Wood* hard, white with a pinkish tinge. *Pores* moderate-sized, scanty, often subdivided, immersed in large wavy, more or less concentrically disposed patches of pale tissue. *Medullary rays* fine, numerous, regular.

Salween valley in Tenasserim.

This, one of the most beautiful flowering trees in the world, was discovered by Mr. Crawford and Dr. Wallich at Kogun in the Salween valley. It is now cultivated in gardens in Calcutta, Madras, and elsewhere in India; also in Ceylon, where fine specimens may be seen at Kandy. It is propagated by layers.

	lbs.
E 4914. Royal Bot. Garden, Calcutta (Prain)	50

57. TAMARINDUS, Linn.

1. **T. indica,** Linn.; Fl. Br. Ind. ii. 273; Roxb. Fl. Ind. iii. 215; Bedd. Fl. Sylv. t. 184; Brandis For. Fl. 163; Kurz For. Fl. i. 414; Gamble Darj. List 32; Talbot Bomb. List 80; Trimen Fl. Ceyl. ii. 114. The Tamarind. Vern. *Amli, ambli, imli*, Hind.; *Tintiri, tintil, tintul*, Beng.; *Titri*, Nep.; *Teteli*, Ass.; *Tentúli, koya*, Uriya;

Púli, Tam.; *Chinta*, Tel.; *Jojo*, Kól, Sonthal; *Chinch*, Berar; *Neddi*, Khond; *Shenta*, Palkonda; *Sitta, chita, hitta*, Gondi; *Chicha*, Kurku; *Karangi, kamal, asam*, Mysore; *Hunase*, Kan.; *Amli, chitz*, Mar.; *Siyembela*, Cingh.; *Magyi*, Burm.

A large evergreen tree. *Bark* ½ in. thick, dark grey, with longitudinal fissures and horizontal cracks. *Wood* hard, close-grained: sapwood yellowish-white, sometimes with red streaks; heartwood small, near the centre of old trees only, dark purplish-brown, with an irregular outline and radiating ramifications, very durable. *Annual rings* indistinct. *Pores* moderate-sized, uniformly distributed, each pore or group of pores surrounded by round patches of soft tissue, which are sometimes confluent. *Medullary rays* very fine, very numerous, uniform and equidistant.

Said to be indigenous in Central Africa; cultivated in India, Burma, and Ceylon as far north as the Jhelum, as an avenue and "tope" tree, and in parks and gardens, also for its fruit. Sometimes found in the forests, but always either on the sites of old villages or come up from scattered seeds.

A very beautiful tree growing to a very large size and a great age. Emerson Tennent mentions one at Point Pedro, Ceylon, that was 42 ft. in girth at the base, and in "Ceyl. Forester," i. 4, the tree in Muttur in Kottiar is mentioned, under which Robert Knox was captured in 1659, as now having a girth of 30 ft. 6 in.

The weight and transverse strength have been ascertained by the following experiments:—

Experiment by whom conducted.	Year.	Wood whence procured.	Weight.	No. of experiments.	Size of bar.	Value of P.
			lbs.		ft. in. in.	
Puckle	—	Mysore	83	4	2 × 1 × 1	792
Skinner, No. 121 . .	1862	South India	79	—	—	864
Cunningham . .	—	Gwalior	60	2	2 × 1 × 1	614, sapwood
" . . .	—	"	79	2	2 × 1 × 1	815, heartwood
Adrian Mendis, No. 79	1855	Ceylon	80	—	2 × 1 × 1	780
Specimens examined .	1878–99	Various	80	3	—	heartwood
H. H. O'Connell . .	1886	Coimbatore	57	—	—	$a = 0{\cdot}00843$

The wood is highly prized, though extremely difficult to work. It is, however, a pity that the amount of heartwood is so small. It is said not to be durable if exposed to weather, but very good for inside fittings in houses. It is used for wheels, mallets, planes, furniture, rice-pounders, oil and sugar mills, and is an excellent wood for turning (Brandis). The fruit is used in medicine as a laxative; it is made into preserves and exported to Europe. The leaves are also used in curries, and the seed, ground to powder and mixed with gum, gives a strong cement. Cut in two, and rubbed on a scorpion-bite, it is said to be a certain cure (A. Lodge). Graham Anderson says it is of no use to shade coffee, as nothing will grow under it. Tents pitched under it in wet weather get damaged, perhaps by the acid in the leaves. The leaves are frequently eaten and destroyed by the small Bruchid beetle (*Caryoborus gonagra*, Fabr.).

			lbs.
C 2811.	Melghát, Berar (Brandis)	sapwood	61
P 451.	Ajmere	sapwood	63
E 2353.	Siliguri, Bengal (Gamble)	sapwood	63
D 2014.	Mysore (Kurz)	heartwood .	82
D 4029.	Madras	heartwood	80
No. 79, Ceylon Collection, old; No. 126, new (Mendis)		heartwood	79

Nordlinger's Sections, vol. 5 (doubtful).

58. HUMBOLDTIA, Vahl.

Five species, all trees of South India. *H. laurifolia*, Vahl.; Fl. Br. Ind. ii. 273; Bedd. Fl. Sylv. xciii.; Trimen Fl. Ceyl. ii. 115; Vern. *Gal-karanda*, Cingh., is a small

tree of damp forests in Malabar and Ceylon. *H. unijuga*, Bedd.; Fl. Br. Ind. ii. 274; Bedd. Fl. Sylv. t. 183, is a handsome tree of the Travancore Ghâts at 3–4000 ft., said to give a hard durable timber. *H. Brunonis*, Wall.; Fl. Br. Ind. ii. 274; Bedd. Fl. Sylv. xciii., is a small tree of the Western Ghâts in Coorg, S. Kanara and Nilgiris.

1. **H. Vahliana,** Wight; Fl. Br. Ind. ii. 274; Bedd. Fl. Sylv. xciii. Vern. *Koratthi*, Mal.

A small tree. *Wood* light brown, moderately hard. *Pores* scanty, usually subdivided, large, evenly distributed. *Medullary rays* numerous, fine but indistinct.

Evergreen forests of the W. Ghâts, Nilgiris to Travancore, up to 2000 ft.; sholas about Coonoor (Bedd.).

		lbs.
W 4722.	Travancore (Bourdillon)	33

2. **H. decurrens,** Bedd.; Hook. Ic. Plant. t. 2368.

A tree. *Wood* light brown, with a very small irregular dark red heartwood; structure similar to that of *H. Vahliana*, but *pores* rather more numerous and *medullary rays* clearer.

Travancore mountains, about Colatoorpolay.

		lbs.
W 4690.	Travancore (Bourdillon)	44

59. AFZELIA, Smith.

Contains two trees: *A. retusa*, Kurz Fl. Br. Ind. ii. 274; Kurz For. Fl. i. 412, is a small evergreen tree of the coast forests of the Sundarbans and the Andamans. The *Marabow* tree of Malacca is probably *A. palembanica*, Baker.

1. **A. bijuga,** A. Gray; Fl. Br. Ind. ii. 274; Kurz For. Fl. i. 412. *Jonesia triandra*, Roxb. Fl. Ind. ii. 220. Vern. *Shoondul, hinga, bhiála, bhudála*, Beng.; *Pyingado*, Burm. in the Andamans; *Pirijdá, dagundá*, And.

A moderate-sized evergreen tree. *Bark* thin, grey, peeling off in fine papery scrolls. *Wood* moderately hard: sapwood light brown, large in young trees, small in old trees; heartwood reddish-brown, hard, close-grained. *Pores* moderate-sized to large, often oval, often subdivided, enclosed in oval- or diamond-shaped patches of loose pale tissue, sometimes more or less concentrically confluent, prominent on vertical sections. *Medullary rays* fine, numerous, uniform and equidistant, wavy, making a pretty silver-grain on a radial section.

Tidal coast forests of Bengal, the Andaman Islands and Burma (?).

Kurz says the wood is used in the Andamans for beams and girders of bridges, and for posts, and is durable. Brandis' "Memorandum on Andaman Woods, 1874," Nos. 12, 13, gives W = 50 lbs.; the specimens give 44 lbs. The tree coppices well. The Sundarbans specimens may possibly belong to *A. retusa.*

		lbs.
E 403, 415.	Sundarbans (Richardson)	36 and 42
B 315.	Burma (1867) (*Kohbeng*)	49
B 524.	Andaman Islands (General Barwell)	45
B 2209.	„ „ (Colonel Ford, 1866)	48

60. PAHUDIA, Miq. *P. xylocarpa*, Kurz For. Fl. i. 413, is an erect unarmed tree of the Shan Hills in Upper Burma. *P. martabanica*, Prain Ind. For. xxvi. 312, is a large tree found by W. A. Hearsey on the Tenasserim river.

Tribe IV. BAUHINIEÆ.

61. BAUHINIA, Linn.

About 32 species, of which perhaps twelve are trees and shrubs, and the rest climbers. Besides those here specially described, there are none of any great importance. They are all easily recognized as belonging to this genus on account of the two leaflets being

joined together for a portion of their length, forming apparently a bilobed, palmately veined leaf.

B. tomentosa, Linn.; Fl. Br. Ind. ii. 275; Roxb. Fl. Ind. ii. 323; Bedd. Fl. Sylv. xcii.; Brandis For. Fl. 159; Talbot Bomb. List 81; Trimen Fl. Ceyl. ii. 116; Vern. *Kachnar*, Hind.; *Kanchini*, Tam., Tel.; *Petan*, Cingh., is a shrub or small tree of S. India, often cultivated, with showy yellow flowers having a purple eye, and a tough wood, with nearly black heartwood. *B. acuminata*, Linn.; Fl. Br. Ind. ii. 276; Roxb. Fl. Ind. ii. 324; Brandis For. Fl. 159; Kurz For. Fl. i. 296; Vern. *Kanchan*, Beng.; *Kachnar*, Hind.; *Mahalegabyu*, Burm., is a white-flowered pretty shrub of Bengal, S. India and Burma, much cultivated in gardens. *B. enigmatica*, Prain, is a small tree of Upper Burma and the Shan Hills. *B. foveolata*, Dalz. (*B. Lawii*, Bth.; Fl. Br. Ind. i. 277; Talbot Bomb. List 81); Vern. *Buswanpad*, Kan.; *Kanchin*, Mar., is a diœcious large tree of the moist forests of the Konkan and N. Kanara.

Of the climbing shrubs, with the exception of the two mentioned, there are none of any great consequence, *B. diphylla*, Symes, of the dry forests of Upper Burma down to Prome, being perhaps the most important. *B. piperifolia*, Roxb. Fl. Ind. ii. 327, is a large climber of Eastern Bengal. *B. macrostachya*, Wall., *B. ornata*, Kurz, and *B. ferruginea*, Roxb., are all large climbers of Burma. *B. diptera*, Coll. and Hemsl., is found in the Shan States. *B. Pottingeri*, Prain, is a recently discovered large climber of the Kachin Hills.

Wood red or reddish-brown, moderately hard, no heartwood, but occasional dark patches; alternate concentric bands of hard and soft tissue, sometimes very prominent (*B. racemosa*), sometimes very faint (*B. malaborica*). *Pores* scanty, usually moderate-sized, ringed with soft tissue. *Medullary rays* fine, very numerous, regular.

1. **B. racemosa**, Lam.; Fl. Br. Ind. ii. 276; Bedd. Fl. Sylv. t. 182; Brandis For. Fl. 159; Kurz For. Fl. i. 397; Talbot Bomb. List 81; Trimen Fl. Ceyl. ii. 116. *B. parviflora*, Vahl; Roxb. Fl. Ind. ii. 323. Vern. *Kaliar*, Kashmir; *Kosúndra, taur*, Pb.; *Kachnál, gúriál, thaur, ashta, makkúna, amli, maula, dhorára*, Hind.; *Jhinjhora*, Dehra Dún; *Dhondri, dhundera, astra, bosha*, Gondi; *Jhinja*, Ajmere; *Ari, arro*, Tel.; *Ati, archi, areka*, Tam.; *Apta, seyára*, Mar.; *Banraj*, Beng.; *Ambhota*, Uriya; *Aupta, banne*, Kan.; *Amba bhósa*, Bhil; *Bossai*, Kurku; *Jinga*, Jeypore; *Kaimu*, Kól; *Ghatonli*, Oraon; *Katmouli*, Kharwar; *Beriju*, Sonthal; *Jhinga, jija*, Merwara; *Choveri*, Khond; *Palan*, Burm.; *Mayila*, Cingh.

A small deciduous tree. *Bark* ¼ in. thick, blackish, very rough, with deep vertical cracks. *Wood* brown, hard, with irregular dark patches near the centre; in alternate concentric, wavy bands of dark hard tissue and pale soft tissue, of nearly equal widths, the soft bands anastomozing. *Pores* moderate-sized, scanty and irregularly scattered, radially subdivided, or in short radial lines, surrounded by rings of soft tissue, and usually in the soft bands. *Medullary rays* numerous, very fine, uniform and equidistant, silver-grain faint, but the alternate bands characteristic on vertical sections.

Sub-Himalayan tract and Lower Himalaya from the Ravi eastwards to Bengal, ascending to 5000 ft.; Central India, Western and Southern India, common in dry deciduous forests; dry forests and savannahs of Prome in Burma; dry region of Ceylon.

A very characteristic short crooked tree, conspicuous in the cold season from its persistent fruit. The wood is a good fuel, but is not otherwise used. The inner bark gives a strong and durable rope, and also affords slow-matches for matchlock men (Brandis). Weight of the wood about 46 lbs.; Brandis' Burma List, 1862, No. 32, gives 44 lbs., R. Thompson 56 lbs.

		lbs.
P 453.	Ajmere	47
P 3216.	Nagpahar, Ajmere	—
O 247.	Garhwal (1868)	53
O 335.	Gorakhpur (1868)	47
C 200.	Mandla, C.P. (1869)	56
C 1170.	Ahiri Reserve, C.P. (R. Thompson)	44
C 2770.	Melghát, Berar (Brandis)	41

kanchan, rakta kanchan, koiral, Beng.; *Kodwari*, Gondi; *Koliári*, Kurku; *Singyara*, Sonthal; *Kundrow*, Mal Pahari; *Kachnar, koilári*, Berar; *Buruju*, Kól; *Kopu*, Khond; *Boda*, Palkonda; *Godetta*, Koya; *Godugura*, Reddi; *Atmatti*, Mar.; *Kanchan*, Tel.; *Pedda aré, mandareh*, Tam.; *Sarúl, kanchivála*, Kan.; *Mahahlegani*, Burm.

A moderate-sized evergreen, usually bushy tree. *Bark* about ½ in. thick, ash-coloured to dark brown. *Wood* pinkish-white, turning dark brown on exposure, moderately hard; wavy concentric bands of soft tissue alternating with darker-coloured bands of firm tissue. *Pores* moderate-sized, mostly oval, subdivided, usually in the soft bands. *Medullary rays* pale, fine, uniform and equidistant, prominent in the bands of firm tissue.

Sub-Himalayan tract and Lower Himalaya from the Indus eastward, rising to 4000 ft.; Central India, Deccan, Orissa, the Circars and Carnatic; scarce in Burma.

An ornamental tree with pink flowers, appearing in winter among the foliage. It is chiefly found in valleys and along streams, often also in Sál forest. The wood is used for agricultural implements and for construction when large enough; the bark in tanning; the flower-buds as a pickle; and the leaves for cattle-fodder (Brandis). Skinner, No. 24, gives W = 39 lbs.; the average is about 45 lbs. per cubic foot. It is occasionally grown in gardens.

		lbs.
P 153.	Sainj, Giri Valley, Simla, 3000 ft.	42
O 229, 230.	Garhwal (1868)	55 and 46
C 822.	Bairagarh Reserve, Berar (Drysdale)	50
C 2792.	Melghát, Berar—sapwood (Brandis)	36
E 585.	Khooklong Forest, Darjeeling Terai (Manson)	50
D 4237.	Nallamalai Hills, Kurnool	47

Nordlinger's Sections, vol. 10 (Tab. VI. 4).

6. B. variegata, Linn.; Fl. Br. Ind. ii. 284; Roxb. Fl. Ind. ii. 319; Bedd. Fl. Sylv. xcii.; Brandis For. Fl. 160; Kurz For. Fl. i. 397; Gamble Darj. List 31; Talbot Bomb. List 82. Vern. *Kachnar, koliár, kurál, padrián, khwairal, guriál, gwiar, bariál*, Hind.; *Taki*, Nep.; *Rha*, Lepcha; *Rakta kanchan*, Beng.; *Borara*, Uriya; *Kurmang*, Mechi; *Singya*, Kól; *Kandol*, Bhumij; *Jingya*, Sonthal; *Kanaraj, kovidara, kanchan*, Mar.; *Segapu-munthari*, Tam.; *Kanchivala-do*, Kan.; *Bwècheng*, Burm.

A moderate-sized deciduous tree. *Bark* grey, with vertical cracks. *Wood* greyish-brown, with irregular patches of harder and darker wood in the centre, moderately hard; alternate more or less concentric wavy, broken and anastomozing bands of dark firm tissue and slightly lighter soft tissue. *Pores* scanty, often subdivided, moderate-sized to large, in rings of soft tissue and usually in the soft belt. *Medullary rays* numerous, fine, rather indistinct, silver-grain inconspicuous, but pores well marked on vertical sections.

Sub-Himalayan tract and Lower Himalaya from the Indus eastwards; dry forests over most of Eastern, Central and South India and Burma; frequently cultivated.

One of the most beautiful of Indian trees when in flower in the hot season. It is then devoid of leaves, and the large white flowers with usually four white and one pink or variegated petal, cover the branches. The wood is used for agricultural implements; the bark in dyeing and tanning, and the leaves and flower-buds as a vegetable (Brandis). R. Thompson gives the weight of the wood as 54 lbs., the average is about 44 lbs. per cubic foot.

		lbs.
H 105.	Bhajji, Punjab Hills, 3000 ft.	—
P 1200.	Madhopur, Punjab (F. Halsey)	33
C 823.	Bairagarh Reserve, Berar (Drysdale)	48
E 591.	Khooklong Forest, Darjeeling Terai (Manson)	47
E 2351.	Bamunpokri " " " (Gamble)	39

7. B. anguina, Roxb. Fl. Ind. ii. 328; Fl. Br. Ind. ii. 284; Kurz For. Fl. i. 403; Gamble Darj. List 31. The "Snake climber." Vern. *Nagpút*, Sylhet; *Naiwilli*, Nep.

A large, very long, climber with stems twisted alternately one way and the other, between the straight thickened margins. *Bark* brown, rough. *Pores* very large and structure very loose.

Forests of Northern and Eastern Bengal, Chittagong, Burma and S. India.
The bark is also used for ropes.

E 482. Darjeeling Terai.
Nordlinger's Sections, vol. 5 (*Caulotretus scandens*, L.).

SUB-ORDER III. MIMOSEÆ.

Contains 15 genera, divided under two Tribes.

Tribe I. Mimoseæ	Xylia, Entada, Adenanthera, Prosopis, Dichrostachys, Piptadenia, Parkia, Leucæna, Mimosa, Acrocarpus.
„ II. Acacieæ	Acacia, Albizzia, Calliandra, Pithecolobium, Inga.

Of these genera *Leucæna* is the only one of non-indigenous trees.

The structure of the woods of the trees of the Sub-Order *Mimoseæ* differs more from that of those of the other Sub-Orders than they do from each other; still the same general character holds good of rather scanty pores, always surrounded, either singly or by groups or by belts, with a certain amount, if only a narrow ring, of soft tissue. Where there are concentric belts they are, as also are *Cæsalpinieæ*, more regular than in the *Papilionaceæ*, where waviness is such a marked feature.

TRIBE I. MIMOSEÆ.

62. XYLIA, Benth.

1. **X. dolabriformis,** Benth.; Fl. Br. Ind. ii. 286; Bedd. Fl. Sylv. t. 186; Brandis For. Fl. 171; Kurz For. Fl. i. 419; Talbot Bomb. List 82. *Mimosa xylocarpa*, Roxb. Fl. Ind. ii. 543. *Inga xylocarpa*, DC. The Ironwood Tree of Pegu and Arracan. Vern. *Jambu*, Hind.; *Jamba, yerúl, suria*, Mar.; *Boja, kongora, tangani*, Uriya; *Tangedi*, Khond; *Irúl*, Tam.; *Kada*, Mal.; *Konda tangedu, tangedu, eruvalu, bojeh*, Tel.; *Jambé, tirawa*, Kan.; *Irúl, irummala, pangáli*, Trav. Hills; *Orjori*, Khond; *Tangani*, Saura; *Tangudu*, Palkonda; *Shilve*, Coorg; *Pyingado, pyin*, Burm.

A large deciduous tree. *Bark* ¼ in. thick, grey or reddish-brown, with short cracks irregularly distributed. Sapwood small; heartwood dark brown or reddish-brown, extremely hard, cross-grained, the fibres on a longitudinal section being wavy. *Annual rings* indistinct. *Pores* large and moderate-sized, filled with resin, often subdivided into numerous compartments, and then oval or oblong, the groups in irregular patches of loose tissue, which are often arranged in oblique lines. *Medullary rays* fine, very numerous, undulating.

Eastern and Western Ghâts of South India in deciduous forest, extending north to Orissa and Bombay, but not beyond Chanda in C.P., often more or less gregarious as in S. Kanara and Malabar and the Upper Godavari; all deciduous forests in Burma and Arracan, "as far north as 24° North Lat. in the Irrawaddy Valley" (J. W. Oliver).

After Teak, *Pyingado* is the most important timber tree of Burma, and the chief of the associates of Teak in the forests. On good and suitable soil it reaches a large size, 90 to 100 ft. in height with 9 to 12 ft. in girth; on poor soil it remains a comparatively small tree, and the bole becomes short and poor. The same thing is noticed of it in Mr. J. Nisbet's Report on Arracan, and I can speak to a very similar condition of growth in the hills of Rekapalle and Rumpa on the Godavari, where *Xylia* is the chief tree in the forests, and where the boles of the trees are often twisted and knotty and only too often

unsound within. There too, in suitable places, it grows well and of large size. Beddome describes quite similar phenomena as occurring on the Western Coast; in the forests of the lower western slopes of the mountains of S. Kanara, Malabar and Travancore it grows to a large size and of fine timber, but in the forests at the foot of the Ghâts, where, as in Godavari and in Arracan and Burma, it is almost or quite gregarious, the stunted badly-shaped trees are found.

The reproduction of *Pyingado* is usually very good, seedlings are abundant and, whether they obtain complete light or not, come on well. Foulkes, in his "Timber Trees of S. Kanara," talks of "the difficulty being, not to obtain reproduction but to 'prevent its absorbing too large a proportion in the distribution of the stock," and speaks of *Tirawa* as a "worthless because unsaleable tree." He remarks that (1) the germination of the seed is rather aided than damaged by fire; (2) the pod and seed being heavy obtain lodgment on slopes where other and lighter seeds would be washed away; (3) the tree prefers a gneiss to a laterite soil; (4) in old Kumri cultivation, *Tirawa* succeeds better than most kinds (I have seen much the same on the Godavari); (5) it bears much shade; (6) the tree is little eaten by cattle; so that in likely places it has a tendency to oust other and possibly better kinds. In Burma it often comes up profusely in old "taungyas."

The wood is very durable, a property which it doubtless owes in great measure to the resinous substances contained in it. The resin is more abundant in Burmese wood than in that grown in S India. No. B 1451, brought by Dr. Wallich from Tavoy in 1828, is still so full of resin that it is quite sticky on the outside, and the resin may be scraped off with a knife. The resin is partially soluble in hot water, to which it imparts a reddish colour.

The chief use of the wood is for railway sleepers, large numbers of which are now cut in Burma and exported to India. It is the chief wood used on the Burma railways, and is said to have been very durable. It is also eminently suited for paving-blocks, and has been successfully tried for the purpose in Rangoon. Good blocks were exhibited in Paris in 1900. The Burma Ordnance Dept. use it for tent-pegs. It is also excellent for telegraph-posts. The local uses are for boat-building, agricultural implements, carts and tool-handles. It is a valuable building wood, especially for piles and beams of bridges, but it has the disadvantage of being heavy and difficult to cut.

The weight and transverse strength have been determined by the following experiments:—

Experiment by whom conducted.	Year.	Wood whence procured.	Weight.	No. of experiments.	Size of bar.	Value of P.
			lbs.		ft. in. in.	
Puckle	1859	Mysore	58	—	2 × 1 × 1	693
List of woods	1863	"	58	—	—	—
Brandis, No. 37.	1862	Burma	60·66	—	—	—
Commissariat Department	---	Moulmein	83	—	—	1153
Skinner, No. 83.	1862	South India	58	—	—	836
Benson	--	Burma	83	—	3 × 1·4 × 1·4	1191
Laslett	1875	"	73·5	6	7 × 2 × 2	955
Molesworth	—	—	58	—	—	880, E = 4150
H. H. O'Connell	1886	Coimbatore	57	—	5½ × 1 × 1 5½ × 1½ × 1½ 5½ × 2 × 2	a = 0·00837
Bourdillon.	1886	Travancore	59	—	—	—
Talbot	1885	Bombay	61	1 3	7 × 2 × 2 6 × 2 × 2	402 663
Specimens examined.	1878-99	Various	61	10	—	—

It is probable that 60 lbs. per cubic foot may be taken as an average weight.

Of the rate of growth little is known, but some specimens have shown a growth of 5 rings per inch, which is fast.

The wood is said to give a good tanning extract, and this may find a use for the sawdust obtained in the Rangoon mills.

	lbs.
C 3514, 3546. Khurdha Forests, Orissa (Gamble)	54
C 3959, 4063, 4103. Rekapalle Forests, Godavari (Gamble) . .	57
C 1151. Ahiri Reserve, Central Provinces (R. Thompson) . .	59
W 754, 761, 857. South Kanara (Cherry)	59, 60, 61
W 1222. North Kanara (Barrett)	62
B 805. Tharrawaddi, Burma (Ribbentrop)	67
B 3066. Burma (Brandis, 1862, No. 37)	66
B 1451. Tavoy (Wallich, 1828)	62

Nordlinger's Sections, vol. 9; vol. 4 (*Inga xylocarpa*) (Tab. VI. 5).

63. ENTADA, Adans.

1. E. scandens, Benth.; Fl. Br. Ind. ii. 287; Brandis For. Fl. 167; Kurz For. Fl. i. 416; Gamble Darj. List 31; Talbot Bomb. List 82; Trimen Fl. Ceyl. ii. 119. *Mimosa scandens*, Roxb. Fl. Ind. ii. 554. Vern. *Gilla*, Beng.; *Geredi*, Uriya; *Pangra*, Nep.; *Taktokhyem*, Lepcha; *Gardal*, Bombay; *Garambe, garbe*, Mar.; *Puswel*, Cingh.; *Dobin, gôn nyin*, Burm.

A large climber with spirally twisted stems. *Bark* brown, rough. *Wood* dark brown when dry, in alternate layers of woody and bark tissue. *Pores* extremely large with very thick white walls. *Medullary rays* not apparent.

Forests of the Eastern Himalaya, Eastern Bengal, South India, Burma, the Andaman Islands and Ceylon.

This plant is at once recognized by its huge pods, often 2 to 4 ft. long and 4 to 5 in. broad, containing large flat round seeds, which are eaten after being roasted. Children play with them, and they may be hollowed out into snuff-boxes and other articles.

E 477. Darjeeling Terai (Manson).

64. ADENANTHERA, Linn.

Two species. *A. bicolor*, Moon; Fl. Br. Ind. ii. 287; Bedd. Fl. Sylv. xciv.; Trimen Fl. Ceyl. ii. 120, t. 34. Vern. *Mas-mora*, Cingh., is a low-country Ceylon tree.

1. A. pavonina, Linn.; Fl. Br. Ind. ii. 287; Roxb. Fl. Ind. ii. 370; Bedd. Fl. Sylv. t. 46; Brandis For. Fl. 168; Kurz For. Fl. i. 417; Talbot Bomb. List 82; Trimen Fl. Ceyl. ii. 120. Vern. *Rakta-chandan, ranjana*, Beng.; *Ani kundamani*, Tam.; *Bandi gurivenda*, Tel.; *Manjati*, Mal.; *Thorlaganj*, Mar.; *Manjádi*, Kan.; *Gung*, Magh; *Yweygyee*, Burm.; *Rechedá*, And.; *Madatiya*, Cingh.

A deciduous tree. *Bark* grey. *Wood* hard, close-grained: sapwood grey, heartwood red. *Pores* small, scanty, in groups or short radial lines. *Medullary rays* very fine, extremely numerous.

Forests of Gorakhpur in the North-Western Provinces (Duthie); Eastern Himalaya (I never saw it in Sikkim); Khandésh, the Konkan and North Kanara in Bombay (Talbot); Northern Circars (doubtful); Travancore, doubtfully indigenous (Bourdillon); tropical forests all over Burma and adjacent islands, extending north to the Shan Hills Terai; Ceylon, common but generally planted (Trimen); elsewhere planted.

There seems to be considerable doubt as to the real home of this tree in a wild state. Beddome says that he never saw it wild, nor have I in any part of India that I have visited. The Gorakhpur habitat seems undoubted, at any rate. The tree is very commonly planted, especially in South India.

Weight: Skinner, No. 12, gives 56 lbs., which is the same as our specimen; Bennett gives 55 lbs. Skinner gives P = 863; and Bennett 942. The wood is used in South India for house-building and cabinet-making purposes, and gives a red dye. The seeds are worn as ornaments, and are used as weights by goldsmiths and jewellers, as they are said to be very constant in weight, viz. 4 grains; they give an oil.

	lbs.
D 3978. Agri.-Hortl. Garden, Madras (Steavenson) . . .	41 (sapwood)
B 523. Andaman Islands (Gen. Barwell)	56
No. 68, Ceylon Collection, new (Mendis)	56

65. PROSOPIS, Linn.

Two species. *P. Stephaniana*, Kunth; Fl. Br. Ind. ii. 288; Brandis For. Fl. 171. Vern. *Jembút*, Arab., is a thorny shrub of the Punjab from Ambála to Peshawur and thence to Baluchistan.

Some years ago, about 1878, a considerable endeavour was made to acclimatize the Mesquit bean of Texas (*P. pubescens*, Bth.) and allied species, on account of their sweet succulent pods, but without success. A few specimens may still be seen here and there.

1. P. spicigera, Linn.; Fl. Br. Ind. ii. 288; Bedd. Fl. Sylv. t. 56; Brandis For. Fl. 169; Talbot Bomb. List 83. *Adenanthera, aculeata*, Roxb. Fl. Ind. ii. 371. Vern. *Jhand, khár*, Pb.; *Kandi, kundi*, Sind; *Chaunkra*, Agra; *Khejra*, Rajputana; *Sangri*, Pertabgarh; *Semru, hamra*, Guz.; *Shemi, saunder*, Mar.; *Shami*, Beng., Uriya; *Perumbe, vunne, jambu*, Tam.; *Chani*, Tel.

A moderate-sized, deciduous, thorny tree. *Bark* ¾ to 1 in. thick, grey, rough, with deep longitudinal fissures and horizontal cracks. *Wood* very hard: sapwood large, whitish, perishable; heartwood purplish-brown. *Pores* small to moderate-sized, often subdivided, generally embedded in narrow irregular concentric bands of soft tissue, filled with resin. *Medullary rays* short, numerous, fine, wavy.

Arid and dry regions of India, in the Punjab, Sind, Rajputana, Guzerat, Bandelkhand and the Deccan, rarely in close forest, but more usually in open "rakhs" or on stony lands with only occasional trees or groups of trees.

The Jhand is a very useful tree, possessing great vitality, a rapid growth and considerable power of reproduction from coppice shoots. Owing to its enormously long tap root (one exhibited at Paris in 1878 was 86 ft. long, having penetrated vertically for 64 ft.; and another similar one is on the wall of the Wood Museum at the Royal Gardens, Kew), it is enabled to withstand the hottest winds and the dryest seasons, and to remain alive when other plants would succumb. Fernandez says of it: "In the 'Punjab and Rajputana, with a rainfall varying from 12 to 25 in., it is gregarious 'on high ground, where, the depth of the stratum of permanent moisture being very 'far below the surface of the soil and the subsoil being strongly saline or consisting of 'shingle and boulder beds, no other trees or even large shrubs can grow. Descending 'towards the main drainage channels, it is obliged to yield a less or greater portion of 'the ground to other trees. In Sind, where the rainfall is less than 10 in., the pure '*Prosopis* forest approaches much nearer to the streams, but still remains above the 'level of inundations. In Bandelkhand from the Nerbudda southwards the tree is 'no longer gregarious" ("Man. of Ind. Sylviculture," p. 106). It is the chief fuel tree of the Punjab, and the wood is an excellent fuel, largely used for locomotives and steamers. Brandis gives the result of an experiment made at Karachi in May, 1869, when it was found that only 1374 lbs. of Jhand were required to evaporate 11·8 cubic ft. of water per hour in 7 hours, at 27 lbs. pressure of steam per square inch against 1388 lbs. of Babúl and 1627 of *Tamarix gallica*.

Skinner gives (No. 108) W = 72 lbs., but the identification of his specimens is doubtful; Dalzell gives 58 lbs.; J. L. Stewart 51 lbs.; the specimens examined 58 lbs. Skinner gives P = 981. The wood is tough, but not durable, liable to dry rot and readily eaten by insects. The pods are used as fodder for camels, cattle and goats. "They are called '*Shângar*,' and give a farinaceous pulp of a pleasant flavour which 'is eaten green or dry by all classes" (W. Coldstream). The flavour is like that of the Carob bean. The tree gives a gum which is not used.

		lbs.
P 882.	Multán, also P 939 (rootwood) (Baden-Powell)	57
P 1380.	Karokpo Forest, Hyderabad, Sind	59
P 459.	Ajmere (young tree)	57

Nordlinger's Sections, vol. 8 (Tab. VI. 6).

66. DICHROSTACHYS, DC.

1. D. cinerea, W. and A.; Fl. Br. Ind. ii. 288; Bedd. Fl. Sylv. t. 185; Brandis For. Fl. 171; Talbot Bomb. List 83; Trimen Fl. Ceyl. 121. *Mimosa cinerea*, Roxb.

Fl. Ind. ii. 561. Vern. *Vurtuli*, Hind.; *Buiyah*, Jeypore; *Yelatri*, Berar; *Kunlai, kunrat, kheri*, Merwara; *Sigumkati*, Mar.; *Vadatalla, vadatara*, Tam.; *Velturu, yeltu*, Tel.; *Segum kati*, Gondi; *Bunthula*, Reddi; *Andara*, Cingh.

A thorny shrub or small tree. *Bark* grey or light brown, fibrous, very thin, deeply fissured vertically, peeling off in thin flakes. Heartwood red, streaked with black, extremely hard. *Pores* scanty, moderate-sized, enclosed in rings of soft tissue. *Medullary rays* short, fine, scanty, equidistant.

Dry, stony hills in South and Central India, Rajputana; dry region of Ceylon.

An interesting twisted gnarled little tree with tasselled flowers, upper half yellow, lower red, and twisted pods. A good fuel tree, the wood very tough and strong, and used for walking-sticks.

	lbs.
P 3239. Ajmere	—
P 3229. Nagpahar, Ajmere	—
D 4447. South Arcot, Madras (Wooldridge)	90
No. 25, Salem Collection	79
No. 3, Ceylon Collection (marked *Vachellia farnesiana*)	71

67. PIPTADENIA, Benth.

1. **P. oudhensis,** Brandis For. Fl. 168; Fl. Br. Ind. ii. 289. *Adenanthera oudhensis*, J. L. Stewart. Vern. *Gainti*, Oudh.

A moderate-sized tree. *Bark* ½ in. thick, grey-brown to dusky red, rough with flattish, exfoliating woody scales; inner bark red, fibrous; bark of young trees furnished with conical spines. *Wood* yellowish or reddish, close-grained, no heartwood, hard, durable. *Pores* moderate-sized and large, often subdivided, in patches of soft tissue, which are sometimes confluent. *Medullary rays* short, numerous, moderately broad.

Forests at the foot of the Nepal Hills, Gonda Division, Oudh, discovered by Mr. R. Thompson in 1871, and since found also in Eastern Kumaon by Mr. Broun.

O 3084. Gonda, Oudh.
O 4871. Oudh (Duthie).

68. PARKIA, R. Br.

Three species. *P. leiophylla*, Kurz For. Fl. i. 418; Vern. *Thetmagyi*, Burm., is a large tree of the tropical and moister upper mixed forests on the eastern slope of the Pegu Yoma. *P. insignis*, Kurz; Fl. Br. Ind. ii. 290; Kurz For. Fl. i. 418; Vern. *Myauktanyet*, Burm., is a large tree of the tropical forests of Martaban with yellowish wood turning pale brown and rather heavy.

1. **P. Roxburghii,** G. Don; Fl. Br. Ind. ii. 289. *Mimosa biglobosa*, Roxb. Fl. Ind. ii. 551. Vern. *Sapota*, Sylhet.

An erect tree. *Bark* dark grey, transversely wrinkled. *Wood* grey. *Pores* large, in patches of loose tissue joined by concentric bands of similar consistency. *Medullary rays* fine.

Assam, Eastern Bengal, Chittagong and Burma.

A handsome tree with the habit of *Albizzia stipulata*. Flowers in round white balls.

O 3264. Botanic Garden, Saharanpur (Duthie).

69. LEUCÆNA.

1. **L. glauca,** Benth.; Fl. Br. Ind. ii. 290; Brandis For. Fl. 172; Talbot Bomb. List 83.

A small tree. *Bark* thin, greyish-brown. *Wood* white, hard.

Pores moderate-sized, usually subdivided, enclosed in patches of white soft tissue which have a tendency to run together into concentric belts. *Medullary rays* fine to moderately broad, the distance between them about equal to the transverse diameter of the pores.

Commonly cultivated; not uncommon in the outer valleys of Kumaon and Garhwal (Brandis). Probably introduced from tropical America.

O 3657. Botanic Garden, Saharanpur (Duthie).

70. MIMOSA, Linn.

Four species. *M. pudica*, Linn.; Fl. Br. Ind. ii. 291; the Sensitive Plant; Vern. *Lajwánti*, Kumaon; *Lajjina*, Nep.; *Lajuk*, Beng.; *Tikayôn*, Burm.; *Nidi-kumba*, Cingh., is now naturalized over the greater part of tropical and sub-tropical India, where it grows to be a small shrub, and is with difficulty eradicated. It is often a great nuisance in forest nurseries and in gardens. *M. polyancistra*, Bth. in Trans. Linn. Soc. xxx. 421, is a thorny shrub of the Seshachellam Hills in Cuddapah with few comparatively large rounded leaflets.

1. **M. rubicaulis**, Linn.; Fl. Br. Ind. ii. 291; Brandis For. Fl. 172; Gamble Darj. List 32; Talbot Bomb. List 83. *M. mutabilis*, Roxb. Fl. Ind. ii. 564. Vern. *Rál*, *khair*, *didriár*, Pb.; *Hajeru*, Sind; *Agla*, *alay*, *ál*, Dehra Dún; *Katdad*, Kumaon; *Kingli*, *kingrei*, Rohilkhand; *Kacheyta*, Gorakhpur; *Atélu*, Jeypore; *Sega*, Sonthal; *Dandudeta*, Kól; *Arai*, Kharwar; *Tsikeri*, Khond; *Aradi*, Nep.; *Sibriú*, Lepcha; *Chilatti*, Bhíl.

A large, straggling, prickly shrub. *Bark* grey. *Wood* hard: sapwood yellowish-white; heartwood red. *Pores* small and moderate-sized, frequently oval and subdivided. *Medullary rays* fine and very numerous.

Throughout the greater part of India, ascending to 4000 ft. in Kumaon and Sikkim.

A very common thorny shrub of the Indian forests, chiefly found in grass savannah lands, in second-growth forests, and in abandoned cultivation. It is very troublesome to penetrate. The wood has been used for gunpowder charcoal; it is of good quality, but small.

		lbs.
E 680.	Bamunpokri, Darjeeling Terai (Manson)	41
E 2354.	Chunbati, Darjeeling, 2000 ft. (Gamble)	52

2. **M. hamata**, Willd.; Fl. Br. Ind. ii. 291; Talbot Bomb. List 84. Vern. *Arkur*, Bombay; *Chilatti*, Berar.

A straggling prickly shrub. *Bark* reddish-brown, fibrous, thin. *Wood* hard: sapwood yellowish; heartwood red. *Pores* moderate-sized, often subdivided, rather scanty, surrounded by a white ring. *Medullary rays* fine, numerous.

Dry forests of the Deccan and Northern Circars, often on black cotton soil.

D 4156. Ellore forests, Godavari (Gamble).

71. ACROCARPUS, W. and A.

1. **A. fraxinifolius**, Wight; Fl. Br. Ind. ii. 292; Bedd. Fl. Sylv. t. 44; Brandis For. Fl. 158; Kurz For. Fl. i. 410; Gamble Darj. List 32. Vern. *Mandania*, Nep.; *Madling*, Lepcha; *Mallay kone*, Tinnevelly; *Kilingi*, Badaga; *Hantige*, *belanji*, *havulige*, Kan.; *Shegappu agili*, Kader; *Kurangadi*, *kuranjan*, Travancore Hills; *Yetama*, *mayahnin*, Burm.

A lofty deciduous tree. *Bark* thin, light grey. *Wood* moderately hard: sapwood white; heartwood light red. *Pores* moderate-sized to very large, often oval and divided into two to five compartments, either isolated or enclosed in narrow interrupted more or less concentric

patches of soft tissue, prominent on a vertical section. ***Medullary rays*** **fine and moderately broad, rather scanty, wavy.**

Eastern Himalaya in Sikkim and Bhutan, ascending to 4000 ft.; Chittagong Hills; Nallamallai Hills of Kurnool in the Deccan; Western Ghâts from South Kanara through Coorg, the Wynaad Nilgiris and Anamalais to Travancore, up to 4000 ft.; tropical forests of the Pegu Yoma in Burma.

One of the largest timber trees of India: in the Sikkim Himalaya it reaches 100 to 120 ft., with a lofty cylindrical stem branching only at a considerable height. One specimen at Dalingkot, measured by Sir D. Brandis in my company, was 181 ft. high and 110 ft. to first branch; Beddome mentions trees in South India 200 ft. high and 150 ft. to the first branch, with immense girth and large buttresses ("Ind. Forester," ii. 196); he also records a tree 27 ft. in girth above buttresses.

The wood is used by planters in Darjeeling for tea-boxes and furniture, in the Wynaad for building and furniture, in Mysore and Coorg for shingles. It reproduces easily and is easily cultivated, but at high elevations is tender to frost—witness the saplings planted about Coonoor.

The scale insect, *Dactylopius adonidum*, Linn., is reported to damage this tree considerably in Mysore.

	lbs.
E 667. Lama-Gumba Forest, Darjeeling (Manson)	39
D 1085. Madura, Madras (Beddome)	39

Nordlinger's Sections, vol. 9.

TRIBE II. ACACIEÆ.

72. ACACIA, Willd.

This very important Indian genus contains about 22 species indigenous in India as well as several introduced trees. The indigenous species fall readily into three sections, two of which contain trees or shrubs, the third climbers. Of the first two, the first is distinguished by having straight spines and the flowers in rounded heads—in it come *A. Farnesiana, planifrons, arabica, eburnea, Jacquemontii, tomentosa, Kingii, inopinata,* and *leucophlœa*, nine species in all; the second by curved thorns and the flowers in elongated spikes—in it come *A. Suma, Catechu* (including *Catechu, catechuoides* and *Sundra*), *ferruginea, Senegal, modesta, lenticularis* and *Latronum*, seven species. Of the climbers there are six species.

A. tomentosa, Willd.; Fl. Br. Ind. ii. 294; Bedd. Fl. Sylv. xcv.; Talbot Bomb. List 85; Trimen Fl. Ceyl. ii. 124; Vern. *Anaimalli*, Tam., is a rare small tree of the west and south of India and Ceylon. *A. Kingii*, Prain, and *A. inopinata*, Prain, are trees of the Shan Hills.

A. concinna, DC; Fl. Br. Ind. ii. 296; Bedd. Fl. Sylv. xcv.; Brandis For. Fl. 188; Kurz For. Fl. i. 423; Gamble Darj. List 33; Talbot Bomb. List 85 (*Mimosa concinna*, Roxb. Fl. Ind. ii. 565); Vern. *Ailah, rassaul*, Oudh; *Ban-ritha*, Beng.; *Sigekai*, Deccan; *Gogu, chikai*, Tel.; *Sigé*, Kan.; *Subôk*, Burm., is an extremely thorny scandent shrub of most parts of India and Burma, except the arid and dry regions. Its thick fleshy pods are used for washing the hair and the acid leaves are eaten. *A. pruinescens*, Kurz For. Fl. i. 424, is a climber of the forests of Pegu, extending north to the Kachin Hills. *A. pseudo-Intsia*, Miq. is very common in the Andaman Islands.

The three chief introduced species are the Australian *A. Melanoxylon*, R. Br., *A. dealbata*, Link, and *A. de currens*, Willd., herein specially described. Besides these three there are several others cultivated and more or less run wild on the Nilgiris, the chief of which is probably *A. pycnantha*, Bth., the "Golden Wattle," or "Broad-leaf Wattle," which is the best species for tanning-bark and gum. The wood weighs 51½ lbs. per cubic foot. *A. homalophylla*, Cunn. is the "Myall wood," a small tree with a hard dark wood having the scent of violets.

The character of the woods of the Indian species of ***Acacia*** **is to have sharp prominent medullary rays, which are short in** ***A. Catechu, ferruginea*** **and** ***modesta***, **but long in the others; as a rule, they are not well marked on a radial section, but** ***A. leucophlœa*** **and** ***arabica*** **form an exception. The** ***pores*** **are, as a rule, uniform in size, but in**

A. eburnea they vary from small to large. With regard to their distribution, two series may be distinguished. In the first series the pores are isolated and enclosed in very narrow rings of softer tissue, and do not form concentric bands; to this section belong *A. arabica, modesta, lenticularis* and *ferruginea*. In the species of the second series, the *pores* are enclosed in elongated patches of soft tissue, which are frequently confluent and form distinct, though often irregular, concentric bands. This section includes *A. leucophlœa, eburnea, Jacquemontii, Senegal, Latronum, Suma* and *Catechu*. The Australian species have a different structure, and are all marked by short medullary rays. So, too, the climbing species differ in more porous wood, but while *A. pennata* joins the first section somewhat, *A. Intsia* similarly joins the second.

1. **A. Farnesiana,** Willd.; Fl. Br. Ind. ii. 293; Bedd. Fl. Sylv. t. 52; Brandis For. Fl. 180; Kurz For. Fl. i. 420; Talbot Bomb. List 84. *Mimosa Farnesiana*, Linn.; Roxb. Fl. Ind. ii. 557. Vern. *Wilayati kikar, wilayati babúl, pissi babúl, gú-kikar*, Hind.; *Gúya babula*, Beng.; *Vedda vala*, Tam.; *Kusturi, piktúmi, oda sale, murki tumma*, Tel.; *Jáli*, Kan.; *Kankar*, Mar.; *Nanlòngyaing*, Burm.

A thorny shrub. *Bark* light brown, rough. *Wood* hard, close-grained: sapwood white; heartwood red, irregular. *Pores* moderate-sized, single or in patches or in concentric interrupted bands of soft tissue, often filled with resin. *Medullary rays* fine, numerous.

Indigenous in America, now cultivated all over India. The gum is collected in Sind. It has yellow, extremely fragrant flowers, from which a perfume is extracted, known as "Cassie." It makes a good fence.

	lbs.
P 3076. Sabathu, Punjab	49
O 4468, 4577. Forest School Park, Dehra Dún (Gamble) . . .	54
No. 5, Ceylon Collection, new (Mendis)	71

2. **A. planifrons,** W. and A.; Fl. Br. Ind. ii. 293; Bedd. Fl. Sylv. xcv.; Trimen Fl. Ceyl. ii. 123, t. 35. The Umbrella Thorn. Vern. *Odai, udai*, Tam.; *Salé*, Tel.

A small tree. *Bark* ¼ in. thick, greyish-brown, with horizontal markings. *Wood* hard: sapwood white; heartwood red. *Pores* small and large, enclosed in white patches of loose tissue, often subdivided or in groups, which again are often confluent into irregular concentric bands, often filled with resin. *Medullary rays* fine, numerous.

Common and gregarious in the extreme south in the districts of Madura and Tinnevelly; Mannar island and adjoining coast in Ceylon.

This tree has the regular umbrella shape, a short bole with branches spreading out and curved downwards, and is the characteristic tree of the region in which it grows. Trimen says that when in flower in Mannar, the trees are covered with white blossoms and look like old hawthorns. The wood is hard, heavy, and used for agricultural implements and other purposes, but most especially as fuel, for which it is excellent, and is in regular use on the railway (S. Indian). The pods are used to feed cattle, goats, etc.

D 3662. Coimbatore, Madras (Beddome).

3. **A. arabica,** Willd.; Fl. Br. Ind. ii. 293; Bedd. Fl. Sylv. t. 47; Brandis For. Fl. 180. Talbot Bomb. List 84; Trimen Fl. Ceyl. 122. *Mimosa arabica*, Roxb. Fl. Ind. ii. 557. The Babúl tree. Vern. *Kikar*, Pb.; *Babbar, kalikikar*, Sind; *Babúl, babúr*, Hind.; *Gabur bakar*, Sonthal; *Babola*, Mal Pahari; *Karúvelam*, Tam.; *Túma, nella túma*, Tel.; *Gobli, jali, karrijáli*, Kan.; *Ramakantha*, Bombay.

A moderate-sized or large tree. *Bark* dark brown, rough. *Wood* hard: sapwood large, whitish; heartwood pinkish-white, turning reddish-brown on exposure, mottled with dark streaks. *Pores* moderate-

sized, sometimes large, oval and subdivided, in patches of pale loose tissue, which are occasionally confluent in more or less regular but usually interrupted concentric rings. *Medullary rays* fine and moderately broad, short, numerous, unequally distributed, conspicuous on a radial section.

Probably wild in Sind, Rajputana, Guzerat and the N. Deccan; cultivated and self-sown in the drier regions of India, but not found in the wet country. It is common in the lower valley of the Ganges, in the Deccan and Carnatic, and especially affects black cotton soil, old tank beds in South India, and mounds among the fields of the rice country. It is usually gregarious in patches of forest, or else scattered in single trees or small groups.

A very important tree in arid and dry regions and on suitable soil, giving a valuable wood, bark, pods used in tanning and other products; and the forests of it are consequently carefully treated, made into Reserves and worked systematically. Among such Forest Reserves may be mentioned those of Sind, which supply fuel to the railways and steamers on the Indus; the Babúl "bans" of Berar and the Bombay Presidency and Hyderabad; and the Babúl forests of the Kistna District and a few other places in the Madras Presidency. Reproduction is, however, often difficult; for, though the tree comes up freely self-sown, it often disappoints the forester on areas where it is regularly worked. In Sind the seeds are found to be regularly destroyed by insects, so that those which have passed through goats germinate best (Schlich). A common practice in some parts is to park goats in the forest and feed them on the pods; the seeds pass undigested, but in a better condition for germination. It coppices well, and may be grown from cuttings. It does not grow to a very large size: Brandis mentions, however, trees at Jacobabad which reached 50 to 60 ft. in height, with a girth of 6 to 8 ft., and that in less than thirty years; and Fagan speaks of one at Pandharpar 80 ft. high and 14 ft. in girth. Ordinarily, in Sind, it reaches 4 ft. girth in thirty-five and 6 ft. in fifty-five years, and in the Punjab 2½ ft. in twelve and 5 ft. in about thirty years (Brandis). Minniken reported the rate of growth in the Delhi Bela plantation as about 2 ft. girth at 7½ years, and an average of 2·3 rings per inch of radius, which is very fast. Mr. Lushington's experiments in Guntur ("Ind. Forester," xxi. 252, with an interesting account of the method of working Babúl forests) gave 10 years, 7 in. girth; 15 years, 14 in.; 20 years, 19½ in.; 25 years, 25 in.; 30 years, 34 in., and 35 years, 43 in., which latter is equivalent to about 5 rings per inch. The forest was being worked in "coppice under standard" on a rotation of twenty years for fuel and fencing thorns. On the growth of Babúl and its cultivation and treatment in the Bombay Presidency, Mr. R. Fagan's paper in "Ind. Forester," x. 393, 441, is also recommended for study. It is called "The Babúl Meadows of the Sholapur District;" he gives a full account of the tree, and the origin of the "meadows," with his views on treatment and reproduction.

Weight: Cunningham gives 54 lbs.; Skinner, No. 3, 54 lbs.; J. L. Stewart, 48 lbs.; our specimens give an average of 54 lbs. Cunningham's five Gwalior experiments with bars 2′ × 1″ × 1″ gave P = 875; Skinner gives 884. The wood is very durable if well seasoned. It is used extensively for wheels, well-curbs, sugar and oil-presses, rice-pounders, agricultural implements and tool-handles. In Sind it is largely used for boat-building, rafters and for fuel; also occasionally for railway sleepers (Brandis). It is a good fuel, but some of the railways object to it, the drivers saying that in combustion the products injure the boilers. However, it is believed that no such difficulty has occurred on the North-Western Railway, which burns, or used to burn, much of it. An analysis of the ashes gave 0·84 lb. out of 100 lbs. steam-dry wood, and out of this 0·69 lb. was calcium carbonate. The gum, which is similar to gum arabic, is largely collected and used in native medicine, and in dyeing and cloth-printing. In Sind and Guzerat large quantities of lac are collected on it. The bark is used for dyeing and tanning, and is a powerful astringent; a decoction of it may be used as a substitute for soap. The pods also, when unripe, are astringent, and are used to make ink, and in Africa for tanning; they are given as fodder to cattle, sheep and goats. The branches and leaves are also used for fodder, and the thorny boughs to fence fields.

The Babúl is one of the trees attacked and injured by *Pachydissus holosericeus*, Fabr., a Cerambycid beetle which bores large holes in the wood. It is also damaged when young by *Cœlosterna spinator*, Fabr., a beetle which resembles the Sál girdler, *C. scabrata*, Fabr.

Babúl is largely cultivated in the Punjab and Sind, but it suffers much from frost. It is useful as an avenue tree in places where other trees would not grow, but it has, on the one hand, the disadvantage of being attacked by the caterpillar of a moth (*Kumli puchi* in Madras common talk), which lets itself down by a thread from the branches, and if it falls on the skin causes intolerable itching; and on the other, the advantage of being shady in the hot season when so many other trees are bare.

		lbs.
P 1198.	Madhopúr, Punjab (F. Halsey)	58
P 890.	Multán (Baden-Powell)	49
P 1379.	Miani Forest, Sind	56
P 440.	Ajmere	—
C 843.	Amraoti, Berar (Drysdale)	56
D 1051.	Salem, Madras (Beddome)	56
D 3853.	Gooty, Anantapur, Madras (Lodge)	56
D 4017.	Collegal, Coimbatore (Peet)	49
No. 1, Salem Collection		50
	Nordlinger's Sections, vol. 11.	

I have not attempted to discuss here the well-known varieties of the tree. Of these there are three chief ones—*Telia*, with blackish bark and short thorns; *Kaoria*, with grey bark and long white spines; and *Ramkanta*, with fastigiate branches (F. B. Dickenson, "Notes on the Flora of Berar," 1894).

4. **A. eburnea,** Willd.; Fl. Br. Ind. ii. 293; Bedd. Fl. Sylv. xcv.; Brandis For. Fl. 183; Talbot Bomb. List 85; Trimen Fl. Ceyl. ii. 124. *Mimosa eburnea*, Roxb. Fl. Ind. ii. 558. Vern. *Bhés babúl*, Garhwal; *Pahari kikar*, Dehra Dún; *Marmati*, Dekkan; *Udai vél, kal udai*, Tam.

A small deciduous tree. *Bark* rough, dark grey. *Wood* hard, yellowish-white, often with a red heartwood. *Pores* moderate-sized and large, often oval and subdivided into compartments, enclosed in wavy and irregular concentric bands of soft tissue, which are frequently interrupted. *Medullary rays* fine and moderately broad, wavy, prominent in the bands of darker and finer tissue, which alternate with the soft ones.

Sind and the Suliman Range up to 3000 ft. or more; Outer Himalaya and sub-Himalayan tract to Kumaon and Oudh; Berar, the Deccan and Carnatic, abundant about Salem; dry regions of the North-East of Ceylon; often on black cotton soil.

A pretty tree, with pink or yellow flowers, nowhere very common. The wood is not used except as fuel. Weight about 54 lbs. per cubic foot. The tree often has, as discovered by Mr. R. C. Wroughton, its twigs attacked, in the Poona District, by a fungus, *Æcidium esculentum*, Barcl. The fungus forms a swelling, and this is eaten by the natives.

		lbs.
O 4513.	Saharanpur Siwaliks (Gamble)	52
O 4467.	Forest School Park, Dehra Dún	74 (wet)
C 844.	Amraoti Reserve, Berar (Drysdale)	52
C 3961.	Bhadrachalam, Upper Godavari (Gamble)	50
D 4022.	Coimbatore (Peet)	62
D 4335.	Ravúr Forest, Nellore (Brougham)	52
	Nordlinger's Sections, vol. 9.	

5. **A. Jacquemontii,** Benth.; Fl. Br. Ind. ii. 293; Brandis For. Fl. 183; Talbot Bomb. List 85. Vern. *Hanza*, Afgh.; *Kikar, babúl, bamúl*, Pb.; *Murmutti*, Berar; *Ratabouli*, Guz.; *Baonli*, Merwara; *Gulli bouli*, Jeypore.

A bushy, thorny shrub. *Bark* thin, smooth, greyish-brown. *Wood* white or yellowish-white, hard. *Annual rings* marked by a dark line. *Pores* scanty, moderate-sized to large, in patches of light loose tissue which are concentrically arranged and sometimes join. *Medullary rays* irregular, fine or moderately broad, sharply defined.

Dry region of the Punjab, Sind, Rajputana and Guzerat, extending to the Suliman

range and Lower Himalaya west of the Jhelum up to 3000 ft.; usually along water-courses and in ravines.

The branches are used for fodder, and the bark of the root in the distillation of spirits. Growth about 10 rings per inch of radius.

P 4832. Montgomery District, Punjab (Munshi Fazl-ud-din).

6. A. leucophlæa, Willd.; Fl. Br. Ind. ii. 294; Bedd. Fl. Sylv. t. 48; Brandis For. Fl. 184, t. 27; Kurz For. Fl. i. 421; Talbot Bomb. List 85; Trimen Fl. Ceyl. ii. 125. *Mimosa leucophlæa*, Roxb. Fl. Ind. ii. 558. Vern. *Rerú, raunj, karír, nimbar, ringa, rinj, rohani, jhind, safed kikar*, Hind.; *Arinj*, Rajputana; *Raundra, runjra*, Banswara; *Rinjra*, Kurku; *Renuja*, Bijeragogarh; *Tumma, reunja, rinja*, Gondi *Gwaria*, Uriya; *Goiri*, Khond; *Hewar*, Mar.; *Haribawal*, Guz.; *Velvaylam, vel-vaghe*, Tam.; *Tella túma, harwar*, Tel.; *Bili jáli, topal, naibela*, Kan.; *Katu andara, maha-andara*, Cingh.; *Tanaung*, Burm.

A moderate-sized or large deciduous tree. *Bark* ⅓ in. thick: colour varying with age, grey and smooth when young; dark brown, almost black and rough when old; exfoliating irregularly in patches and strips. *Wood* hard; sapwood large; heartwood reddish-brown or nearly brick-red, with lighter and darker streaks. *Pores* moderate-sized, uniformly distributed, in patches or short irregular concentric belts of pale soft tissue, alternating with dark-coloured firm tissue. *Medullary rays* white, fine and moderate-sized, often slightly bent.

Plains of the Punjab from Lahore to Delhi; Siwalik Hills from the Ravi to the Ganges; Rajputana, Central, Western and Southern India; dry forests of Prome in Burma; dry region of Ceylon.

A common and rather conspicuous but not handsome tree, common in most dry forests. The wood is good, seasons well, and takes a good polish; is strong and tough, but often eaten by insects. It gives an excellent fuel. The bark has been eaten in times of scarcity; it is used in distillation of palm spirits to precipitate by its tannin the albumen in the palm juice. It gives a fibre for nets and coarse cordage. The young pods and seeds are eaten, and the gum used in native medicine. Skinner gives (No. 5) W = 55 lbs., P = 861; O'Connell gives W = 66 lbs.; R. Thompson 58 lbs., and the C.P. List of 1873 45 lbs.; the specimens an average of 55 lbs.

		lbs.
P 947.	Lahore (Baden-Powell)	50
C 1118.	Ahiri Reserve, C.P. (R. Thompson)	59
C 3506.	Khurdha Forests, Orissa (Gamble)	—
D 4011.	Cuddapah Forests (Higgens)	56

7. A. Suma, Buch.; Fl. Br. Ind. ii. 294; Brandis For. Fl. 187; Kurz For. Fl. i. 421; Talbot Bomb. List 85. *Mimosa Suma*, Roxb. Fl. Ind. ii. 563. Vern. *Saikanta*, Beng.; *Mugli*, Kan.; *Kumtia*, Pertabgarh; *Dhaula khejra*, Banswara; *Gorádo*, Mandvi; *Son kairi*, Dangs; *Kamtiya*, Mar.; *Gonharea, khoiru, semé*, Uriya (?).

A small tree. *Bark* white or greyish-white, smooth, peeling off in small papery flakes and marked at intervals by horizontal patches of darker colour. *Wood* dark brown, smooth, very hard and heavy, close-grained. *Pores* small, enclosed in pale rings, single or occasionally joined in concentric lines. *Medullary rays* fine, fairly numerous.

Bengal, Orissa and the Circars, common; Assam and Sylhet; N. Kanara and the S. Mahratta country; Deccan and Carnatic; Upper Burma (Kurz).

A tree similar to, and closely allied to, *A. Catechu*, but at once recognized by its white bark. Like that species it gives cutch, and the bark is used for tanning.

Skinner, No. 10, gives W = 77 lbs., P = 801.

		lbs.
C 1308, 1310.	Gumsúr Forests, Ganjam (Dampier)	75 and 76

(In Ed. 1, p. 154, these were doubtfully identified only, but as the tree is very

common in Gumsúr, and the wood cannot belong to *A. Catechu* or *A. leucophlœa*, the other common forest species, I feel that the identification is most probably correct.)

8. **A. Catechu**, Willd.; Fl. Br. Ind. ii. 295; Brandis For. Fl. 186; Kurz For. Fl. i. 422; Gamble Darj. List 32; Bedd. Fl. Sylv. t. 49; Talbot Bomb. List 85. *A. Sundra*, DC; Fl. Br. Ind. ii. 295. Bedd. Fl. Sylv. t. 50; Talbot Bomb. List 85; Trimen Fl. Ceyl. ii. 125. *Mimosa catechuoides*, *M. Catechu*, *M. Sundra*, Roxb. Fl. Ind. ii. 562. The Cutch tree. Vern. *Khair*, Hind.; *Khoira*, *koir*, Ass.; *Khoiru*, Uriya; *Karangalli*, *bágá*, *othalei*, Tam.; *Sandra*, *nalla sandra*, Tel.; *Khair*, *kaderi*, Mar.; *Kagli*, *cachu*, Kan.; *Rat kihiri*, Cingh.; *Sha*, Burm.

The difficult question of the varieties of the Khair has practically been decided by Dr. Prain in Journ. As. Soc. Beng. lxvi. ii. 508. He agrees that the three species of Roxb. are varieties of *A. Catechu*, and that *A. Suma* is distinct. The three varieties are:—

(1) Var. *Catechu*, Punjab, N.-W.P., C.P., Behar, Circars, rare in Burma. Calyx, petals and rachis of leaves hairy.

(2) Var. *catechuoides*, Bengal, Sikkim, Assam, common in Burma. Calyx and petals glabrous, rachis of leaves puberulous.

(3) Var. *Sundra*, Deccan, Carnatic, Rajputana, W. India, U. Burma. Calyx, petals and rachis of leaves glabrous.

The distribution is taken from an examination of over 100 specimens in the Calcutta Herbarium.

A moderate-sized, gregarious, thorny, deciduous tree. *Bark* dark grey or greyish-brown, rough, exfoliating in long narrow strips. *Wood* very hard: sapwood yellowish-white; heartwood either dark or light red. The wood grown in the Himalayan valleys shows the *annual rings* marked by a whitish line and by a large number of pores in the spring wood. *Pores* moderate-sized and large, often subdivided, occasionally in radial groups of 2 or 3, and surrounded by narrow rings of soft tissue, which are often joined and form interrupted concentric bands; they are frequently filled with a white substance, are fairly uniformly distributed, and are distinctly marked on a longitudinal section. *Medullary rays* short, moderately broad, numerous, bent where they touch the pores, which are often larger than the space between two medullary rays.

Common in most parts of India and Burma, extending in the sub-Himalayan tract westwards to the Indus, and ascending to 3000 ft. in the valleys; dry region of Ceylon, where scarce. In Burma it reaches N. Lat. 23½° on the Irrawaddy, and 23° on the Chindwin.

The *Khair* is a very important Indian Forest tree, partly for its timber, but most of all for the astringent products which it gives, *káth* in Northern India, and *cutch* in Burma. In India it is sometimes gregarious, sometimes sporadic. When sporadic, it occurs, as may be readily seen on such a type area as the Siwaliks of Saharanpur, mixed with other trees of the dry deciduous forest. It reproduces readily from seed or in coppice, and is very useful in quickly reclothing bare slopes and patches, but in such cases it is rarely of large size, and usually presents the appearance of a small, rather stunted tree. When gregarious, it is found—like the Sissoo, and often in its company, though, strangely enough, the two, though growing in the same neighbourhood, prefer to keep apart—on newly raised banks in the beds of torrential streams, like the upper courses of the Ganges and others flowing from the Himalaya. The seed itself is rather heavy, but though the pod is speedily dehiscent, the funicle is strong, so that pod and seeds get washed down and the seeds rubbed off among the sand and boulders of newly-thrown-up islands and banks. There they germinate and gradually grow, each year lengthening their roots, and each year covered somewhat with an increasing amount of silt, so that, as with Sissoo, it is usual to see the forest in terraces, the older trees on the highest, the youngest plants on the lowest and latest deposited. As again with the Sissoo, Khair forests are liable to be washed away, and regeneration by seed under the parent trees rarely happens.

An old gregarious river-bed Khair forest rarely shows a seedling of its own kind, Khair, like also Sissoo, preferring a clear bed for germination; and consequently, as is well explained by Eardley-Wilmot in "Stray Leaves," "Ind. Forester," vol. xxv. Appx., the retention of mature trees in working is not necessary; the new growths require no treatment except protection, as they thin themselves, and thinnings for timber are best omitted, as the chief product is not wood, but an extract, and as it is often important to keep the growth dense in order to prevent erosion. Artificial reproduction, if advisable, is best done by sowings, transplants giving very poor results; in Burma, where the cutch industry is very important, such sowings have been largely made, with fair success; but in Burma the growth is more sporadic than gregarious, the trees larger, and natural regeneration usually sufficient with a little help in giving light. In Burma, thus, the "Sha" forests may be either gregarious or sporadic. Usually the tree occurs sporadically in dry forests, often on calcareous sandstone, or on dry ridges with bamboos, and mixed with other trees of the same requirements, such as *Acacia leucophlœa*, *Pentacme siamensis*, etc., and sometimes Teak: but sometimes the "Sha" gradually gets the supremacy and becomes gregarious, especially in the Prome and adjoining Districts (see Kurz For. Fl. i. xxiv.).

Sha trees are considered exploitable as soon as they reach a diameter of 1 ft., but with a view to regeneration and the maintenance of the forest, it is usual to prescribe that the trees shall not be felled till they reach 18 in. girth. The manufacture of cutch is not carried out by Government, but the right to cut and boil is sold annually for fixed areas, and it has not been found possible to fix the annual yield by material, so that the Working Plan is by area, and the usual interval between successive fellings is thirty years. After the trees have been felled and utilized, the area is sown with seed, the reproduction of which is usually found to be excellent.

The growth of Khair is moderately fast: Himalayan specimens show 5 rings per inch of radius, and a specimen from the forest in the bed of the Mahanadi, Darjeeling Terai, showed 24 rings on 6¼ in., or 3·8 rings per inch, which is fast.

Weight: Skinner, No. 11 (*A. Sundra*), gave W = 81 lbs., P = 915; Cunningham's experiment, with bars 2′ × 1″ × 1″ from Gwalior gave W = 70 lbs., P = 779; Brandis, in his Burma List of 1862, gives two varieties, Nos. 29 and 30, with 56 and 70 lbs. respectively; R. Thompson gives 75 lbs.; the C.P. List of 1873 gives 79 lbs.; H. H. O'Connell, in 1886, with Coimbatore wood, found W = 67½, a = 0·00748; the average of the specimens examined 63 lbs. We may take 65 lbs. per cubic foot as the fairest general average weight.

The wood seasons well, takes a fine polish, and is extremely durable. It is not attacked by white ants or by teredo. It is used for rice-pestles, oil and sugar-cane crushers, agricultural implements, bows, spear and sword handles and wheelwrights' work. In Burma it is used for house-posts, and very largely used as firewood for the steamers of the Irrawaddy flotilla. It has been found good for railway sleepers, and it is probably only the smallness of the tree and the consequent waste in cutting up that has prevented its more general use. A number of sleepers were cut for the Northern Bengal State Railway in 1876, but the result is not recorded.

The chief product of the tree is Catechu, an important Catechol tan. In Northern India, under careful preparation, it is produced in the form of "*Kath*," a pale cinnamon-coloured, biscuit-like substance, which is valued as an astringent for chewing with betel and fetches a comparatively high price. This substance is found to be best given by those trees that have much white substance in the pores of the wood (see description of wood), and is obtained by cutting the wood into chips and then placing them in a sieve inside a boiler with water below. As the water boils the steam passes through the chips and extracts the Kath, which is taken off as a sediment and dried. Kath is not soluble in water. In Burma and in other parts of India the product of the tree is "*Cutch*," which is a black shining extract, soluble in water, and used as a tanning material, and exported to Europe for that purpose. The system of preparation is not so careful, and the ordinary red wood is usually employed. The manufacture of these two products has been much under discussion of recent years, and much has been written on the subject, while both products have been prepared experimentally at Dehra Dún. For information on Catechin, which is a crystalline substance extracted from the Cutch tree wood, and on its value as a dye, see Agric. Ledger, No. 35 (1896). For full information regarding "Kath" and "Cutch," see Agric. Ledger, Nos. 1 (1895) and 2 (1896).

An analysis of the ashes of the wood gave 1·18 lbs. of ash out of 100 lbs. of steam-dry wood, and of this as much as 0·83 was calcium carbonate. Khair wood is also

an excellent fuel, and a very good charcoal tree, being preferred in Northern India to all others for burning lime. Well-made charcoal ought to be about 20 to 25 per cent. in weight of the wood used.

The Khair tree is attacked by the Buprestid beetle, *Belionota scutellaris*, Fabr.; and by the Cerambycid beetle, *Stromatium barbatum*, Fabr., which usually attacks Teak; while the sapwood of logs is deeply tunnelled by a Bostrichid beetle, *Synoxilon*, sp., which was discovered in specimens in the Forest School Collection at Dehra. In the Dehra Dún and Saharanpur Siwaliks, one of the chief enemies of the Khair is the porcupine, *Hystrix leucura*, Sykes, which eats the bark off even quite big trees, partly or wholly, and so badly damages or even kills them. The parasite *Loranthus longiflorus* is often found on Khair. Babu U. N. Kanjilal says that the wood is never used for house-building in Dehra Dún and Saharanpur, owing to a superstition against it.

In Ed. 1 of this work, it was shown how the specimens examined came under two categories: (1) ordinary wood, brick-red in colour, and (2) darker harder wood, red-brown in colour. The woods agree fairly in locality with the varieties of Roxburgh, and may here be so enumerated.

Var. 1. *Catechu.*

		lbs.
H 938.	Hazara, Punjab (Baden-Powell)	—
P 604.	Kangra, „ (Pengelly)	54
P 1196.	Madhopur, „ (F. Halsey)	63
P 98.	Sutlej Valley, Punjab, 2000 ft.	63
P 455.	Ajmere	—
O 255.	Garhwal (1868)	53
C 2758.	Moharli Reserve, C.P. (Brandis)	64
E 665.	Rakti Forest, Darjeeling Terai (Manson)	59
E 2356.	Mahanadi Forest, „ (Gamble)	48
	Nordlinger's Sections, vol. 9.	

Var. 2. *catechuoides.*

C 189.	Mandla, C.P. (1866)	59
C 203.	„ „	63
E 625.	Bamunpokri, Darjeeling Terai (Manson)	59
E 2355.	„ „ „ (Gamble)	70
B 1454.	Prome, Burma	75

Var. 3. *Sundra.*

C 3526.	Khurdha Forests, Orissa (Gamble)	62
D 4139.	Sandúr Hills, Bellary (Stafford)	72
	No. 2, Salem Collection	76

No. 3420 is a piece of hard, dark red wood, resembling var. *catechuoides* in appearance and structure. It was obtained from the excavations made at Prince's Dock, Bombay (see "Indian Forester," vol. vi. p. 108), and must be of very great age.

9. A. ferruginea, DC; Fl. Br. Ind. ii. 295; Bedd. Fl. Sylv. t. 51; Brandis For. Fl. 185; Kurz For. Fl. i. 423; Talbot Bomb. List 85; Trimen Fl. Ceyl. ii. 126. *Mimosa ferruginea*, Roxb. Fl. Ind. ii. 561. Vern. *Kaiger*, Panch Mehals; *Son khair, safed khair, brahmani khair*, Berar; *Kar khair*, Gondi; *Phandra khair*, Mar.; *Teóri khair*, Bhíl; *Banni*, Kan.; *Velvelam*, Tam.; *Ansandra, tella tuma, wúni*, Tel.

A large deciduous tree. Bark ½ in. thick, rough. *Wood* very hard, harder than that of *A. Catechu*: sapwood large, yellowish-white; heartwood olive-brown. *Pores* moderate-sized, generally single, in small rounded patches of soft tissue, which are only sometimes confluent. *Medullary rays* short, pale, numerous, fine.

Northern Circars, Deccan and Carnatic; Berar, Panch Mehals, Konkan, Guzerat; Burma (doubtful); dry country of Ceylon.

A prettier tree than *A. Catechu*. The wood is used for building, carts and agricultural implements. Skinner, No. 4, gives W = 60 lbs., P = 798; specimens examined give 70 to 73 lbs.

		lbs.
C 872.	Bairagarh Reserve, Berar (Drysdale)	70
D 1081.	N. Arcot (Beddome)	73

10. A. Senegal, Willd.; Fl. Br. Ind. ii. 295; Talbot Bomb. List 85. *A. rupestris,* Stocks; Brandis For. Fl. 184. Vern. *Khor,* Sind; *Kúmta,* Rajputana.

A small tree. *Bark* thin, smooth, pale greenish-grey, yellowish under the broad dark flakes which peel off. *Wood* hard: sapwood yellowish-white; heartwood nearly black, irregular. *Pores* moderate-sized to large, scanty, in large concentric or interrupted patches of light tissue. *Medullary rays* fine, white, moderately numerous, bent where they touch the pores.

Dry rocky hills in Sind and the Punjab; Northern Aravali hills and other parts of Rajputana; west and south to Africa.

A small thorny tree, giving, it is believed, the true "gum arabic" of commerce, but uncommon in India, so that the trade is small. The wood is used for weavers' shuttles. As real gum arabic is now a valuable product, it is possible that the cultivation of this tree on waste lands in the Punjab, Sind and Rajputana would be profitable.

		lbs.
O 4803.	Forest School Park, Dehra Dún (Gamble)	57
P 4830.	Ajmere (Lala Har Swarúp)	54

11. A. modesta, Wall.; Fl. Br. Ind. ii. 296; Brandis For. Fl. 185. *Mimosa dumosa,* Roxb. Fl. Ind. ii. 559. *M. obovata,* Roxb. *l.c.* 561. Vern. *Palosa,* Afg.; *Phulahi,* Pb.

A thorny, moderate-sized, deciduous tree. *Bark* rough, with a multitude of narrow irregular cracks. *Wood* extremely hard, harder than that of *A. Catechu:* sapwood large, white, perishable; heartwood dark brown, with black streaks. *Pores* moderate-sized, sometimes joined by narrow, very faint bands of white tissue. *Medullary rays* fine, white, short.

Suliman and Salt Ranges, sub-Himalayan tract between the Indus and the Sutlej, and the northern part of the Punjab plains.

Growth slow. Weight, according to Dr. J. L. Stewart, 55 lbs.; the specimens vary from 67 to 72; average 69 lbs. A most beautiful wood, strong and durable; valuable for cart-wheels, sugar-cane crushers, Persian water-wheels and agricultural implements. It gives a gum, used in native medicine. The leaves and fallen blossoms are collected for cattle-fodder (Brandis).

		lbs.
P 164.	Hoshiarpur (J. L. Stewart, 1866)	72
P 944.	Gujerat, Punjab (Baden-Powell)	68
P 945.	Multan " "	67

12. A. lenticularis, Ham.; Fl. Br. Ind. ii. 296; Brandis For. Fl. 186; *A. ferruginea,* Gamble Darj. List 32 (*non* DC). Vern. *Khour,* Nep.

A deciduous, moderately thorny tree. *Bark* brown, somewhat rough, peeling off in small scales, inner bark white. *Wood* very hard, in structure resembling that of *A. ferruginea.*

Lower Himalaya from Kumaon to Bhutan, very scarce.

This is a fine tree with a good wood. The pods resemble those of *Albizzia.*

		lbs.
E 2357.	Bamunpokri, Darjeeling Terai (Gamble)	67

13. A. Latronum, Willd.; Fl. Br. Ind. ii. 296; Bedd. Fl. Sylv. xcv.; Brandis For. Fl. 180. *Mimosa Latronum,* Roxb. Fl. Ind. ii. 559. Vern. *Bhes,* Hind.; *Pakitumma,* Tel.; *Odei usal,* Tam.

A gregarious very thorny shrub or small tree. *Bark* dark reddish-brown, very rough, ½ in. thick, vertically cleft. *Wood* very hard, sapwood light brown, heartwood small, red. *Pores* moderate-sized, often subdivided, single or in groups, surrounded by pale loose tissue,

coalescing into more or less continuous concentric bands. *Medullary rays* moderately broad, showing a silver-grain on a radial section.

South Deccan from the Kistna river to Mysore, gregarious on poor soils.

This tree is like *A. planifrons* in its umbrella-shaped habit, only smaller, the stem scarcely reaching 6 ft., and the branches then spreading horizontally, and making it difficult to penetrate. The thorns are very large, white, in pairs, hollow, and often tenanted by large black ants which attack intruders (Ind. For. ix. 450). The flowers are white and pretty, the wood excellent but small, and only used for fuel. It often covers considerable tracts of country, as at Venkatayapalem in Kistna District, Sidhout in Cuddapah, and places in Anantapur.

		lbs.
D 3760.	Kottakota Forest, Anantapur (Gamble)	69
D 4142.	Sandúr Forests, Bellary (Gamble)	—

14. A. Intsia, Willd.; Fl. Br. Ind. ii. 297; Kurz For. Fl. 423; Gamble Darj. List 33; Talbot Bomb. List 85; Trimen Fl. Ceyl. ii. 127. *A. cæsia*, W. and A.; Brandis For. Fl. 189; Kurz For. Fl. i. 425. *Mimosa cæsia*, and *M. Intsia*, Roxb. Fl. Ind. ii. 565. Vern. *Arhai*, Sutlej; *Alay*, Dehra Dún; *Katrar*, Kumaon; *Harrari*, Nep.; *Payir, ngraem*, Lepcha; *Korinta*, Tel.; *Jarri, chilar*, Mar.; *Kundaru*, Kól; *Hinguru*, Cingh.

A large climbing shrub. *Bark* pale grey, with usually five fluted, spirally-twisted grooves. *Wood* white, soft, porous. *Pores* small and large, in patches of loose tissue which join occasionally into irregular concentric bands which run into each other, and which separate the narrow belts of firmer and darker-coloured tissue in which the white, fine, *medullary rays* are prominent.

Sub-Himalayan tract from the Chenab eastwards, ascending to 4000 ft., throughout India and Burma.

A very troublesome forest climber, which should be cut and destroyed everywhere where the welfare of the forest demands it and a better vegetation is required.

The bark is used by Lepchas in Sikkim as a substitute for soap in washing the hair

		lbs.
O 4652, 4754.	Saharanpur Siwaliks (Gamble)	37
C 3468.	Bandgaon, Singbhúm, Chota Nagpore (Gamble)	—
C 3838.	Gumsúr, Ganjam (Gamble)	—
E 478.	Rakti Forest, Darjeeling Terai (Manson)	—
E 2359.	Chunbati, Darjeeling, 2000 ft. (Gamble)	—
D 4302.	Tinnevelly, Madras (Brasier)	65 (wet)

Nos. C 3468 and C 3838 are rather different; the wood is harder, and the angles of the stem not so prominent as in the other specimens.

I have not attempted to follow Kurz and Prain in separating *A. cæsia* from *A. Intsia*, as it would be impossible now to make sure which of the above specimens belong to either. At the same time, I believe that they were quite right in their views of the species being distinct.

15. A. pennata, Willd.; Fl. Br. Ind. ii. 297; Brandis For. Fl. 189; Kurz For. Fl. i. 424; Gamble Darj. List 33. *Mimosa pennata*, Roxb. Fl. Ind. ii. 565. Vern. *Agla bél, alay*, Dehra Dún; *Agla, awal*, Kumaon; *Biswúl*, Hind.; *Arfu*, Nep.; *Tol rik*, Lepcha; *Suyit, subôk kale*, Burm.

A large climbing shrub. *Bark* reddish-brown, ¼ in. thick, with horizontal cracks. *Wood* porous, moderately hard, reddish-brown. *Pores* oval or oblong, occasionally subdivided into 2 or 3 compartments, from small to extremely large and very numerous, surrounded by or enclosed in an irregular network of pale soft tissue, which separates the patches of darker-coloured and firmer tissue, in which the moderately broad scanty brown *medullary rays* are distinctly visible.

Throughout India and Burma, in almost all forest regions which are not too dry, chiefly along rivers and streams and in ravines, ascending to 5000 ft. in the hills.

A very troublesome climber which should be cut whenever possible, as it climbs over the tallest trees, and its tough, wiry, strong, thorny branches damage them considerably.

Though loose in texture, it has rather a nice wood, which, if carefully cut to show the silver-grain properly, would make pretty frames, boxes, and similar articles.

		lbs.
E 476.	Balasun Forest, Darjeeling Terai (Manson)	—
E 2358.	Sivoke „ „ „ (Gamble)	50
O 4653, 4737.	Kasumri Forest, Saharanpur (Gradon)	39, 37

16. A. dealbata, Link.; Benth. Fl. Austr. ii. 415; Brandis For. Fl. 180. The White Wattle or Silver Wattle.

A small tree. *Bark* grey, fairly smooth. *Wood* moderately hard, light red. *Pores* moderate-sized, often in short linear groups surrounded by pale rings. *Medullary rays* short, fine and moderately broad, well marked on a radial section.

Indigenous in New South Wales, Victoria and Tasmania. Introduced on the Nilgiris, and now naturalized since 1840.

The wood is extensively used in Australia for timber, and the bark for tanning. The "White Wattle" or "Silver Wattle" has been tried in many places in India, and has succeeded fairly in some localities in the Himalaya, as, it is believed, Abbottabad in the Punjab and Almora in Kumaon; but nowhere as it has on the Nilgiris, where it has not only completely naturalized itself, but possesses a power of spreading which might cause it, if not checked, to become a serious nuisance. It has been grown in plantations which are worked for small fuel on a five years' rotation; the chief of these are Brooklands and Snowdon at Ootacamund, and part of Bandy Shola at Coonoor. No. W 1099 was cut from a tree eleven years old and 46 ft. high, with about 12 in. in diameter. The wood is used as fuel, preferably for tradespeople like bakers, who prefer small stuff to large, and by the ordinary population, who like to bring it out themselves in head-loads. The foliage is grey, and the flowers bright yellow, very pretty. The tree is also considerably grown at Newera Ellia and elsewhere in the Ceylon mountains. It reproduces splendidly in coppice or by suckers, less so from seed. The bark is an excellent tanning material, and should be more used.

		lbs.
W 1099.	Nilgiri Hills (Beddome)	—
W 3916.	Ootacamund, Nilgiris, 7000 ft. (Col. Jago)	47

17. A. melanoxylon, R. Br.; Benth. Fl. Austr. ii. 388; Brandis For. Fl. 180. Australian Blackwood. The "Black Wattle" of Nilgiris.

A large evergreen tree. *Wood* soft; sapwood light brown; heartwood dark brown and beautifully mottled, shining, even-grained. *Pores* round or oval, scanty, moderate-sized and divided into compartments, conspicuously marked on a vertical section. *Medullary rays* short and fine.

New South Wales, Victoria, Tasmania and South Australia. Introduced on the Nilgiris since 1840 and now completely naturalized there, as well as at Newera Ellia in Ceylon. It is also being grown in the hills of the Punjab, Kumaon and Sikkim.

This large and handsome tree is now a characteristic feature in the landscape at Ootacamund, Coonoor and Newera Ellia. It has, however, a very sombre foliage, and too much of it is somewhat depressing. Like *A. dealbata*, it has been more or less successfully grown in the Himalaya, but in the Nilgiris it has been said to grow to a finer tree than it does in its own country. The chief plantation of it is "Bandy Shola" near Coonoor, which is, or was, very fine. It is easily raised and grown from seed artificially, but badly naturally. It coppices very badly also, for instead of good shoots a multitude of small twiggy shoots arise which do not give any wood. The soil around it gets completely filled with its rootlets, which may account for the bad reproduction.

The question of the rate of growth was fully gone into by Mr. D. E. Hutchins in his "Report on Measurements of the Growth of Australian Trees in the Nilgiris, 1883"; he found that the Nilgiri trees gave about 4 rings per inch of radius, an annual increment of about 5 to 6 tons of wood per acre, and a reducing factor of 0·535. He found for white wattle a yearly increment of about 3 tons per acre.

The wood is rather like a light-coloured kind of walnut; it can be used for building, but is light and not durable, still it is easily worked by carpenters, while Blue-gum is not. In Australia the wood is used for cabinet-work, coach-building, railway carriages and agricultural implements; and as Mr. Newbery ("Timbers of Victoria," 1877) gives the weight at 41 to 48 lbs. per cubic foot, it is probable that the wood of the introduced tree has degenerated in consequence of the milder climate and quicker growth, and that in Australia the Blackwood is a finer timber than it is on the Nilgiris. The bark gives a useful tan. The trees on the Nilgiris are very liable to be attacked by species of *Loranthus*, which parasites in time kill their host (see Dr. Bidie, "Report on Nilgherry Loranthaceous Plants," Madras, 1874).

		lbs.
W 1100.	Nilgiri Hills (Beddome)	36
W 3909.	Ootacamund, Nilgiris, 7000 ft. (Col. Jago)	42

Hough's American Woods, vol. vii. No. 155.

18. A. decurrens, Willd.; Benth. Fl. Austr. ii. 414. The Common Wattle.

A small tree. *Bark* dark grey. *Wood* moderately hard: sapwood light brown; heartwood reddish-brown. *Pores* moderate-sized, often subdivided, resinous, rather scanty. *Medullary rays* fine, wavy, bent around the pores, not numerous.

Queensland, N.S. Wales, Victoria and Tasmania; cultivated on the Nilgiris and elsewhere.

This tree resembles much the "Silver Wattle," but is not so grey; it is not so common on the Nilgiris, but is perhaps more common in other localities, as on the Himalaya. Newbery gives 45 to 48 lbs. per cubic foot for the weight of the wood. It is the *principal* one whose bark is used for tanning, though not the best. There can be but little doubt that the capabilities of the Nilgiris in exporting either harvested Wattle bark for tanning or tannin extract have not been appreciated as they should. In Northern India, the search for marketable tans of a regular supply has been prosecuted with energy for some time, but nothing seems to have been done on the Nilgiris, where Wattle is a "weed," and miles of it can be grown at a very small cost, and cut over for bark on a five years' rotation. Nordlinger's Sections, vol. 3.

73. ALBIZZIA, Durazz.

Fourteen species, only one of which is not a tree of some size. To the species described in the Fl. Br. Ind., four have been added by Prain and one by Brandis. This latter, *A. Thompsoni*, was discovered in the Chanda District, C.P., but I have specimens which I take to be the same from Saharanpur (Sakrauda Forest, also Siwaliks) in the north, and Ganjam and Cuddapah in the east and south of India. It is possible that one or more of the specimens described under *A. odoratissima* or *A. Lebbek* may be it, but it is now impossible to say. The specimen described is believed to be correct. *A. Kalkora*, Prain in Journ. As. Soc. Beng. lxvi. ii. 511 (*Mimosa Kalkora*, Roxb. Fl. Ind. ii. 547); Vern. *Kalkora*, Beng., is a tall tree of the Khasia and Naga Hills. *A. littoralis*, Teysm. and Binnend. is a tree of the Nicobar Islands. *A. elegans*, Kurz For. Fl. i. 427, is a large evergreen tree of the tropical forests of the Pegu Yoma. *A. Gamblei*, Prain in Journ. As. Soc. Beng. lxvi. ii. 513 (*A. Lebbek*, Gamble Darj. List 33, *non* Bth.); Vern. *Sedong*, Lepcha, is a tree of the Sikkim Lower Hills and Terai and the Naga Hills in Assam. *A. myriophylla*, Bth.; Fl. Br. Ind. ii. 300; Kurz For. Fl. i. 426 (*Mimosa myriophylla*, Roxb. Fl. Ind. ii. 549); Vern. *Tetuliya*, Sylhet, is a climbing shrub of the Eastern Himalaya, ascending to 3000 ft. in Sikkim, Assam, the Khasia Hills and Sylhet, resembling *Acacia pennata*.

A. moluccana, Miq. is a fine tree largely grown in Ceylon and Java as a shade to coffee, just as *A. stipulata* has been grown over tea in Assam. Trimen mentions a tree at Peradeniya, cut down at six and a half years old, which was 89 ft. high, with a girth of 6½ ft. at 3 ft. from the ground. It deserves attention in India in places where it is likely to grow and a fast-growing tree is required. *A. Richardiana*, King and Prain Ann. Calc. ix. 32 (with photograph by J. H. Lace), is a beautiful species grown in the Calcutta Royal Botanic Garden; a native of Madagascar, but worthy of being planted as a quick-growing ornamental tree.

Wood soft to hard (in ascending order of hardness *stipulata, lebbekoides, procera, Lebbek, mollis, Thompsoni, odoratissima, lucida,*

amara): sapwood yellowish-white, not durable; heartwood light to dark brown, streaked, smooth. *Pores* moderate-sized to large, usually scanty, often subdivided, in rings of soft tissue, in groups or short strings, very prominent as dark lines on a vertical section. *Medullary rays* fine, short, usually distant, shallow.

1. **A. Lebbek**, Benth.; Fl. Br. Ind. ii. 298; Bedd. Fl. Sylv. t. 53; Brandis For. Fl. 176; Kurz For. Fl. i. 427; Talbot Bomb. List 86; Trimen Fl. Ceyl. ii. 128. *Mimosa Sirissa*, Roxb. Fl. Ind. ii. 544. The Siris tree. Vern. *Siris, sirín, sirái, kalsis, tantia, garso*, Hind.; *Gokiru*, Kumaon; *Sirisha*, Beng.; *Hirih*, Ass.; *Harreri*, Panch Mehals; *Vaghe, kat vaghe*, Tam.; *Tinia*, Uriya; *Dirasana, darshana, kat vage, pedda duchirram*, Tel.; *Kal baghi, bengha, sirsúl*, Kan.; *Chichola*, Mar.; *Kôkko*, Burm.; *Beymadá, gachodá*, And.; *Mara*, Cingh.

A large deciduous tree. *Bark* brownish-grey, rough with numerous short irregular cracks. *Wood* hard: sapwood large, white or yellowish; heartwood dark brown, streaked with lighter or darker streaks. *Annual rings* sometimes marked by a line. *Pores* scanty, large, in rings of soft tissue, in oblique somewhat radial strings, very prominent as dark streaks on a vertical section. *Medullary rays* fine, distant, not conspicuous in silver-grain.

Sub-Himalayan tract from the Indus eastwards, ascending to 5000 ft.; Bengal, Burma, Central and South India; dry regions of Ceylon: often planted.

This Siris is one of the best-known of Indian trees, as it is not only very common in forests almost all over the country, but is largely cultivated as an avenue and garden tree. When in flower it is pretty, and some people may like the rather sickly scent of the blossoms, but in the early hot season when its leaves are gone and the yellow persistent pods rattle with every puff of the hot wind, it is not beautiful.

The wood varies greatly in weight and strength, as is obvious from the list given below, but it is very useful, and of late years a considerable amount of it has been exported to London from the Andamans. The "burrs" are especially valuable, and fetch ten to twenty times the price of plain wood. It is probably the "East Indian Walnut" of the European market. The logs cut in the Andamans give squares up to 50 ft. long with 3 ft. siding. It is very easily propagated, but if grown alone as in avenues, requires very careful pruning, or it will branch low down and not make a handsome tree. It is much planted along embankments in Burma.

Growth exceedingly rapid during the first year. Brandis says that trees in the Punjab have 2¾ ft. girth in twelve years, and 4½ ft. in thirty years, and that trees at Sakhar in Sind seventeen years old have reached 5 to 6 ft. in girth. This would give from 1 to 3 rings per inch of radius, which is very fast.

The weight and transverse strength have been determined from the following experiments:—

Experiment by whom conducted.	Year.	Wood whence procured.	Weight.	No. of experiments.	Size of bar.	Value of P.
			lbs.		ft. in. in.	
Puckle	1859	Mysore	57	2	2 × 1 × 1	1052
"	"	"	61	4	2 × 1 × 1	959
"	"	"	56	4	2 × 1 × 1	1068
Cunningham	1854	Gwalior	50	2	2 × 1 × 1	486
Baker	1829	Junagarh	55	4	7 × 2 × 2	526
Skinner, No. 7	1862	South India	50	—	—	793
" " 8	"	Burma	46	—	—	855
(List)	"	Mysore	50	—	—	—
Brandis, No. 40	1862	Burma	48	—	—	—
A. Mendis	1855	Ceylon	42	—	—	—
H. H. O'Connell	1886	Coimbatore	50½	—	—	a = 0·00960
Specimens examined	1878–99	Various	47	16	—	—

The wood seasons, works and polishes well, and is fairly durable. It is used for sugar-cane crushers, oil-mills, furniture, well-curbs and wheel-work; in South India for boats. In the Andamans, where trees of large size are procurable, it is used for building, but more usually for house-posts. It is often grown as an avenue tree, but its roots do not penetrate very deep. It grows easily from cuttings. It gives a gum which is not soluble in water, but merely forms a jelly. The leaves and twigs are given as fodder to camels.

	lbs.
P 1193. Madhopur, Punjab (F. Halsey)	47
P . 96. Bhajji, Sutlej Valley, 3000 ft.	43
P 881. Multán (Baden-Powell)	49
P 468. Ajmere	55
E 4757. Chittagong (Quinnell)	38
C 3560, 3567. Khurdha Forests, Orissa (Gamble)	49, 59
D 4004. Cuddapah, Madras	60
D 4014. Collegal, Coimbatore	45
W 728, 748, 751. South Kanara (Cherry)	41, 51, 44
B 1453. Prome, Burma	48
B 2208. Andaman Islands (Col. Ford, 1866)	43
B 4760. Burma (J. W. Oliver)	36
No. 81, Ceylon Collection, old; No. 128, new (Mendis)	42

Nordlinger's Sections, vol. 5 (*A. speciosa*), vol. 9 doubtful.

2. **A. odoratissima**, Benth.; Fl. Br. Ind. ii. 299; Bedd. Fl. Sylv. t. 54; Brandis For. Fl. 175; Kurz For. Fl. i. 427; Gamble Darj. List 33; Talbot Bomb. List 86; Trimen Fl. Ceyl. ii. 129. *Mimosa odoratissima*, Roxb. Fl. Ind. ii. 546. Vern. *Lasrín, karambru, polach*, Pb.; *Siris, siran, bhandír, bersa, bás, bassein, bansa*, Hind.; *Kalei, kala siris*, Merwara; *Chichalda*, Berar; *Koroi, tetura*, Beng.; *Sirsi tentura*, Khond; *Ginnera*, Koya; *Chichwa, chichola, yerjqohetta*, Gondi; *Chichwa*, Kurku; *Kali harreri*, Panch Mehals; *Sedong*, Lepcha; *Jati-koroi*, Ass.; *Moroi*, Cachar; *Kal-thuringi, kar vaghe, bilwara, ponnai murankai, solomanim, sela vanjai*, Tam.; *Shinduga, chinduga, telsu, yerjuchinta, karu vage*, Tel.; *Pullibaghi, billawar, godhunchi*, Kan.; *Borhi, chichua, chichanda*, Mar.; *Karu vagei*, Mal.; *Suriya mara*, Cingh.; *Thitmagyi, thitpyu*, Burm.

A large deciduous tree. *Bark* ¼ in. thick, grey, with irregular cracks and darker patches, granular. *Wood* hard: sapwood large, white; heartwood dark brown, with darker streaks. *Annual rings* sometimes marked by a belt with few or no pores. *Pores* moderate-sized to large, often subdivided, in rings of soft tissue, oblique strings less prominent than in *A. Lebbek*, prominent on a vertical section as dark streaks. *Medullary rays* fine, rather distant, short, silver-grain of long shallow plates.

Sub-Himalayan tract from the Indus eastwards, ascending to 3000 ft.; Bengal, Burma, Central, Western and South India; low country of Ceylon.

A handsomer tree than *A. Lebbek*, but more of a "forest" tree than that species. It is common in mixed forests, especially on hill slopes. S. E. Peal says that it has an excellent reputation in Assam, and that the wood is durable.

Growth rapid, 4 rings per inch of radius. Weight: Wallich gives 45 lbs.; Kyd, 40 lbs.; Skinner, No. 6, 46 lbs.; Brandis, 52 lbs.; Bourdillon, 38 lbs.; the specimens give an average of 54 lbs. Kyd's experiments with Assam wood with bars 2′ × 1″ × 1″ gave P = 547; Brandis found P = 984; Bourdillon, 627; and Skinner 800.

Professor W. C. Unwin's experiments (*Imp. Inst. Journ.*, May, 1899) gave the following results for Ceylon wood:—

Weight	57·01 lbs. per cubic foot.
Resistance to shearing along the fibres	1283 lbs. per square inch.
Crushing strength	4·184 tons per square inch.
Transverse „	6·518 „ „
Coefficient of elasticity	775 „ „

The wood seasons, works and polishes well, and is fairly durable. It is used for wheels, oil-mills and furniture. It gives a dark brown gum. The leaves and twigs are lopped for cattle-fodder.

		lbs.
P 3223.	Nagpahar Forest, Ajmere	—
O 219.	Garhwal (1868)	43
C 184.	Mandla, Central Provinces (1870)	—
C 1122.	Ahiri Reserve, Central Provinces (R. Thompson)	60
C 2748.	Moharli Reserve, Central Provinces (Brandis)	—
C 4220.	Ganjam (perhaps *A. Thompsoni*) (Gamble)	63
C 3960.	Upper Godavari (Gamble)	52
E 4758.	Chittagong Hill Tracts (Quinnell)	47
E 2360.	Bamunpokri, Darjeeling Terai (Gamble)	59
W 725, 1189.	South Kanara (Cherry)	59 and 42
W 4196.	Cochin (Kohlhoff)	47
D 1084.	North Arcot (Beddome)	52
B 290.	Burma (1867)	53
B 3121.	„ (Brandis, 1862)	57
B 1427.	„	57
B 2231.	Andamans (Col. Ford, 1866)	56
No. 8, Salem Collection		52

Nordlinger's Sections, vol. 5.

3. A. procera, Benth.; Fl. Br. Ind. ii. 299; Bedd. Fl. Sylv. xcvi.; Brandis For. Fl. 175, t. 26; Kurz For. Fl. i. 428; Gamble Darj. List 33; Talbot Bomb. List 86. *Mimosa procera*, Roxb. Fl. Ind. ii. 548. The White Siris. Vern. *Safed siris, gurar, karra, karo, karanji, gurbári, gurkur, kalsis, baro, karolu, garso*, Hind.; *Karallu, kini, kilai, kili, tihiri*, Bombay; *Takmur*, Lepcha; *Koroi, medeloa*, Beng., Ass.; *Kili*, Gáro; *Sarapatri*, Uriya; *Pandrai*, Kól; *Garso*, Kharwar; *Lgokri*, Mechi; *Gura manja*, Khond; *Passerginni*, Gondi; *Kinni*, Bhíl; *Gurar, kinhai*, Mar.; *Konda vaghe*, Tam.; *Pedda patseru, tella sopara, tella chinduga*, Tel.; *Chikul, bellati*, Kan.; *Kottu vaga, karunthagara*, Mal.; *Choi*, Magh; *Sit*, Burm.; *Búrdá*, And.

A large, deciduous, fast-growing tree. *Bark* ½ in. thick, yellowish- or greenish-white or grey, smooth, with horizontal lines. *Wood* hard: sapwood large, yellowish-white, not durable; heartwood brown, shining, with alternate belts of darker and lighter colour; very like that of *A. Lebbek*, and often indistinguishable from it. *Annual rings* not usually visible. *Pores* moderate-sized and large, in narrow rings of soft tissue, uniformly distributed in small groups of a few, very prominent on a longitudinal section. *Medullary rays* fine, short, distant.

Sub-Himalayan tract from the Jumna eastwards; Bengal; Satpura Range in the Central Provinces; Guzerat, S. India and Burma; Andamans (north end) and Cocos Islands.

The "White Siris" is a well-known and very conspicuous tree in the Indian forests. It affects low lands near river-banks, and grows with a tall, straight, perhaps more often a somewhat curved bole, branching at a considerable height with large branches and a rounded head. The smooth yellowish-white bark at once distinguishes it. It is easily cultivated, but does not come up naturally as freely as might be expected from the amount of seed it gives. It is often grown in avenues and gardens for ornament. The wood is an excellent fuel. Dr. Leather, experimenting on its calorific power, found that 100 parts of wood gave 6·84 parts moisture, 89·56 carbon and other organic matter, and 3·6 ash; that its calorific power was 86·9 compared to pure carbon 100; and that 13·04 lbs. of water were evaporated by 1 lb. wood at 212° F. The branches are a favourite elephant-fodder.

Growth very rapid. Brandis says that it attains in twelve years 3 to 4 ft., and in thirty years 4 to 6 ft. girth. This would give about 2 rings per inch of radius, which is very rapid. The specimens are of somewhat slower growth, 6 rings per inch.

Weight, according to Skinner, No. 3, 39 lbs.; Brandis, No. 28, 48 lbs.; Bourdillon, 45 lbs.; the specimens give an average of 46 lbs. Skinner gives P = 695; Brandis 750; Bourdillon 738. The wood is straight and even-grained, seasons well, and the heartwood is durable. It is used for sugar-cane crushers, rice-pounders, wheels, agricultural implements, bridges and house-posts. It is used by tea-planters for stakes for laying out tea-gardens, as it is found to split well, and occasionally for tea-boxes and for charcoal, for which it is found to be very good. It gives a copious gum.

		lbs.
O 220.	Garhwal (1868)	41
O 3004.	„ (1873)	44
C 2740.	Jamui Forest, Berar (sapwood) (Brandis)	26
E 2361.	Bamunpokri, Darjeeling Terai (Gamble)	37
E 4763.	Kurseong Division, Darjeeling Terai (Green)	42
E 949.	Eastern Dúars, Assam (Fisher)	51
E 1263.	Tezpúr, Assam (G. Mann)	58
E 2194.	Nowgong, Assam (Kurz)	42
E 1955.	Chittagong (Chester)	43
E 4755.	Chittagong Hill Tracts (Quinnell)	43
B 329.	Burma (1867)	39
B 811.	„ (Ribbentrop)	60
B 2527.	„ (Brandis, 1862)	41
B 506, 518.	Andaman Islands (General Barwell)	53 and 46
B 2247.	Andaman Islands (Colonel Ford, 1866)	41

Nordlinger's Sections, vol. 11; vol. 5 (*M. elata*) doubtful.

4. **A. lucida,** Benth.; Fl. Br. Ind. ii. 299; Brandis For. Fl. 174; Kurz For. Fl. i 429; Gamble Darj. List 33. *Mimosa lucida*, Roxb. Fl. Ind. ii. 544. Vern. *Sil koroi* Beng.; *Tapria-siris*, Nep.; *Ngraem*, Lepcha; *Mess-guch*, Ass.; *Gunhi*, Magh; *Than that*, Burm.

A large deciduous tree. *Bark* dark brown. *Wood* very hard sapwood white; heartwood brown, with dark streaks and alternatin dark and light coloured concentric bands. *Pores* moderate-sized numerous, enclosed by groups in round patches of soft tissue. *Medullary rays* fine and numerous.

Valleys of the North-East Himalaya up to 2000 ft., extending perhaps westwar to Oudh and Kumaon; Assam, Khasia Hills, Sylhet; Upper Burma and down t Prome; scarce in Pegu; often planted.

Weight: average of our specimens, 55 lbs. per cubic foot. Wood hard and good but not used. Lac is obtained on it in Assam. A handsome tree, easily recognize by its larger leaves and few leaflets.

		lbs.
E 660, 677.	Bamunpokri, Darjeeling Terai (Manson)	55 and 61
E 4756.	Chittagong Hill Tracts (Quinnell)	50

5. **A. mollis,** Boivin; Prain in Journ. As. Soc. Beng. lxvi. ii. 514. *A. Julibrissin* Boivin, var. *mollis*, Bth.; Fl. Br. Ind. i. 300; Brandis For. Fl. 177. Pink Siris. Vern *Sirin, kurmru, surangru, shirsh, shishi, búna, tandái, mathirshi, brind, sirsang*, Pb. *Lal siris, baraulia, barau, bhokra*, Hind.; *Kulári*, Kumaon; *Kauner*, Garhwal; *Sirs* Dotiál; *Bhondir, kurmura*, Jaunsar.

A moderate-sized deciduous tree. *Bark* dark grey, with lon horizontal wrinkles. *Wood* hard: sapwood large; heartwood dar brown, almost black in old trees, beautifully mottled, shining. *Annua rings* distinctly marked by a sharp line. *Pores* large, often double very prominent on a longitudinal section. *Medullary rays* fine, short red, appearing as narrow, dark, straight bands in the silver-grain.

Himalaya, from the Indus to Sikkim, ascending to 5000 ft., chiefly in valleys an along watercourses; Assam, Manipur.

Growth rapid, 3 to 4 rings per inch of radius (Brandis); our specimens give 5 ring Weight 43 to 52 lbs. per cubic foot. The wood is used to make furniture. The tre is extremely handsome when in flower, with its innumerable pink tassels of delicat silky blossoms.

		lbs.
H 97.	Sutlej Valley, Simla, 4000 ft.	52
H 152.	Sainj, Simla, 4000 ft.	43

6. **A. stipulata,** Boivin; Fl. Br. Ind. ii. 300; Bedd. Fl. Sylv. t. 55; Brandis For Fl. 178; Kurz For. Fl. i. 426; Gamble Darj. List 34; Talbot Bomb. List 86; Trimen Fl Ceyl. ii. 129. *Mimosa stipulacea*, Roxb. Fl. Ind. ii. 549. Vern. *Oi, oë, sirin, shirsha*

kasir, Pb.; *Siran, kanujerla, pattia, samsundra*, Hind.; *Kala siris*, Nep.; *Singriang*, Lepcha; *Sau*, Ass.; *Selcho*, Gáro; *Chakua, amluki*, Beng.; *Chapún, kora serum*, Kól; *Bunsobri*, Mechi; *Kat turanji, pili vagei*, Tam.; *Konda chiragu, chindaga*, Tel.; *Kal baghi, hote baghi, bagana*, Kan.; *Laeli, udul, kasir*, Mar.; *Motta vaga*, Mal.; *Goiri*, Khond; *Kabal*, Cingh.; *Pokoh*, Magh; *Bonmeza*, Burm.

A large, deciduous, fast-growing tree. *Bark* grey, with numerous short, vertical wrinkles and a few larger horizontal furrows, with prominent edges, darker when old. *Wood* soft: sapwood large, white; heartwood brown, generally not durable, shining. *Annual rings* distinctly marked. *Pores* large, often oval and subdivided, very prominent on a longitudinal section. *Medullary rays* fine, short, reddish, not very distinct.

Sub-Himalayan tract from the Indus eastwards, ascending to 4000 ft.; Oudh, Bengal, Burma, South India; moist low country of Ceylon; Andamans and Nicobars.

Growth very rapid. Roxburgh says that a tree he planted in the Botanic Garden at Calcutta measured 48·5 in. in girth at 4 ft. above the ground when seven years old; this would give a rate of growth of slightly less than 1 ring per inch of radius. Stewart, in "Punjab Plants," p. 56, says that a tree in the Saharanpur Gardens was 7 ft. in girth at about seventeen years of age, which gives rather over 1 ring per inch of radius. The specimens give 3 to 4 rings per inch of radius. A round in the Bengal Forest Museum from a young tree shows 11 rings on a mean radius of 6 in., or 1·8 rings per inch of radius. The growth may be taken, therefore, at 1 to 4 rings per inch of radius, which is very rapid. Weight, according to Skinner, No. 9, 55 lbs.; according to Brandis' Burma List of 1862, No. 27, 66 lbs.; Bourdillon gives 27 lbs.; the specimens give only 33 lbs.; and Kyd (*Acacia marginata*, Ham.) 28 lbs. Kyd gives P = 222; Bourdillon 666; and Skinner gives P = 823; but it is doubtful if his experiments were really from wood of *A. stipulata*. The wood is said by Beddome, probably quoting Skinner, to be used for building and for naves of wheels. Kurz says it is good for cabinet work, furniture and similar purposes. Brandis' Burma List, 1862, No. 27, says it is prized for cart-wheels and for the bells of cattle. In Bengal it has been tried for tea-boxes, for which purpose it will probably suit well; also for charcoal. In Kangra it has been used for tea-boxes (L. G. Smith, "Ind. For." ix. 210). It gives a gum which exudes copiously from the stem, and is used by Nepalese for sizing their "Daphne" paper. The branches are lopped for cattle-fodder. Perhaps the chief use of the tree has been as a shade plant for tea in the plantations in Assam, also perhaps for coffee in S. India. It is strongly believed that the amount of nitrogen in the soil is largely increased by the presence of the Siris, so that the tree has an excellent effect in two ways.

		lbs.
H 603.	Kangra, Punjab (Pengelly)	29
O 217.	Garhwal (1868)	28
C 2989.	Jubbulpore, Central Provinces (1863)	39
E 647.	Bamunpokri, Darjeeling Terai (Manson)	26
E 2362.	„ „ „ (Gamble)	29
E 788.	Kamrúp, Assam (Mann)	40
E 1956.	Chittagong (Chester)	25
E 4759.	Chittagong Hill Tracts (Quinnell)	22
B 809.	Burma (Ribbentrop)	36
B 2528.	„ (Brandis, 1866)	33
B 2221.	Andaman Islands (Col. Ford, 1866)	45

7. **A. amara**, Boivin; Fl. Br. Ind. ii. 301; Brandis For. Fl. 178; Talbot Bomb. List 86; Trimen Fl. Ceyl. ii. 130. *A. amara* and *A. Wightii*, Grah.; Bedd. Fl. Sylv. xcvi. t. 61. *Mimosa amara* and *M. pulchella*, Roxb. Fl. Ind. ii. 548. Vern. *Lallei*, Dekkan; *Wusel*, Madura; *Thuringi, uyil, wúnja, suranji, shekram*, Tam.; *Nallarenga, shekrani, sikkai, narlingi*, Tel.; *Bel-khambi, tugli*, Kan.; *Kadsige*, Coorg; *Oosulay*, Mal.

A moderate-sized deciduous tree. *Wood* very hard: sapwood large, white; heartwood purplish-brown, beautifully mottled, with alternate, concentric, light and dark bands. *Pores* moderate-sized,

scanty, in patches of soft tissue, which are frequently joined, forming short, concentric bands. *Medullary rays* very fine, numerous.

Dry forests in the Deccan and Maratha country, Mysore and the Carnatic, extending to dry places towards the West Coast; dry region of Ceylon.

Skinner, No. 1, gives the weight at 70 lbs.; our specimens give 60 lbs. Skinner also gives P = 1284, and says, "The wood is strong, fibrous and stiff, close-grained, 'hard and durable, superior to Sál and Teak in transverse strength and direct cohesive 'power;" also that it is used for the beams of native houses and carts, the wood of the crooked branches for ploughs, and the leaves for washing the hair. Beddome says it is a good fuel, and is extensively used for the locomotives at Salem and Bangalore.

	lbs.
D 3897, 4068. Cuddapah (Higgens)	60 and 57
D 1052. Salem, Madras (Beddome)	61
No. 6, Salem Collection	62

8. **A. lebbekoides,** Bth.; Prain in Journ. As. Soc. Beng. lxvi. ii. 347. Vern. *Thitmagyi*, Burm.

A moderate-sized tree. *Bark* light yellowish-brown, rough, thin. *Wood* (young tree) light brown, clouded, moderately hard; heartwood dark brown. *Pores* very scanty, large, often subdivided, enclosed in rings of loose tissue, more or less concentrically arranged, very prominent as dark streaks on a radial section. *Medullary rays* fine, not numerous, irregular.

Burma, common.

	lbs.
B 4851. Pyinmana, Burma (G. E. Cubitt)	42
B 5044. Myaungmyo, Burma	46
B 5098. Toungoo, Burma, *sapwood*	37

9. **A. Thompsoni,** Brandis in Ind. For. xxv. 284. Vern. *Silari*, Hind.

A moderate-sized tree. *Bark* dark brown, roughly tessellated with irregular cracks, deep vertically, shallower horizontally, ¼ in. thick. *Wood* hard: sapwood yellowish, heartwood dark brown. *Pores* moderate-sized, often subdivided, fairly numerous, fairly prominent on a vertical section, arranged in more or less concentric groups, singly or in groups surrounded by soft tissue. *Medullary rays* fine, not numerous, shallow.

Deciduous forests of Central India, extending east to Ganjam and northwards to the Siwaliks.

	lbs.
C 4846. Chanda, C. P. (A. E. Lowrie)	47

B 2705 (59 lbs.) from Tavoy (Wallich, 1828) is a dark red specimen of a heavy brown wood of *Albizzia* structure, which cannot be identified.

10. **A. lophantha,** Bth. Fl. Aust. ii. 421; Brandis For. Fl. 174.

A shrub. *Bark* dark grey, smooth, with small narrow horizontal lenticels. *Wood* white, moderately hard; heartwood very small, brown. *Pores* large, very scanty, often subdivided, surrounded by rings of loose tissue, prominent on a vertical section. *Medullary rays* fine, regular, not very numerous.

An Australian shrub, cultivated and more or less naturalized in the hills of the Punjab and on the Nilgiris.

This species is at once recognized from others by its flowers in spikes instead of in heads. The shrub is useful to plant for reclothing denuded slopes.

	lbs.
W 5001. Mangalore, S. Kanara (Latham)	38

74. CALLIANDRA, Bth. *C. umbrosa*, Bth.; Fl. Br. Ind. ii. 302, is a thorny tree of Sylhet, the Khasia Hills, Chittagong and the Kachin Hills of Burma. *C. Griffithii*, Benth. is a tree of the Khasia Hills.

75. PITHECOLOBIUM, Mart.

About 12 species, some of which are quite scarce trees. *P. geminatum*, Benth.; Fl. Br. Ind. ii. 303; Bedd. Fl. Sylv. xcvi.; Trimen Fl. Ceyl. ii. 131, is a small bushy tree endemic in Ceylon. *P. umbellatum*, Benth.; Fl. Br. Ind. ii. 303; Bedd. Fl. Sylv. xcvi.; Trimen Fl. Ceyl. ii. 132; Vern. *Iyamalai, ichavalai*, Tam., is a small tree of S. India and Ceylon. *P. subcoriaceum*, Thw.; Fl. Br. Ind. ii. 305; Bedd. Fl. Sylv. xcvi.; Trimen Fl. Ceyl. ii. 133 (*P. anamallayanum*, Bedd. Fl. Sylv. t. 189); Vern. *Mimini-mara*, Cingh., is a small tree of the hill region of Ceylon at 4–6000 ft., extending to the Anamalai Hills in S. India. *P. affine*, Baker; Fl. Br. Ind. ii. 304, is a tree of the hills east of Tonghoo in Burma. *P. glomeriflorum*, Kurz For. Fl. i. 430 (*Albizzia glomeriflora*, Kurz; Fl. Br. Ind. ii. 300), is a shrub of the higher Martaban Hills at 4–7000 ft. *P. nicobaricum*, Prain, is found in the Nicobar Islands. *P. montanum*, Benth.; Fl. Br. Ind. ii. 306; Vern. *Takpier*, Lepcha, is a tree of the Sikkim Himalaya at about 4000 ft., and the Khasia and Mishmi Hills. *P. angulatum*, Benth.; Fl. Br. Ind. ii. 306; Kurz For. Fl. i. 430; Gamble Darj. List 34 (*Mimosa heterophylla*, Roxb. Fl. Ind. ii. 545); Vern. *Takpyit*, Lepcha; *Kawahuruni*, Sylhet, is a tall handsome tree of the Lower Sikkim Hills, Assam, Eastern Bengal and Burma down to Tenasserim, at low elevations in Sikkim and at 4–6000 ft. in Burma. It is said by Roxburgh to be a large and useful timber tree.

1. **P. dulce**, Benth.; Fl. Br. Ind. ii. 302; Bedd. Fl. Sylv. t. 188; Brandis For. Fl. 173; Talbot Bomb. List 87. *Inga dulcis*, Willd.; Kurz For. Fl. i. 431. *Mimosa dulcis*, Roxb. Fl. Ind. ii. 556. Vern. *Vilayati imli, dakhani babúl*, Hind.; *Karkapilly*, Tam.; *Kywĕdanyin*, Burm.

A large or small tree. *Bark* grey with white lenticels which run both horizontally and vertically. *Wood* white, with a light red heartwood, hard. *Pores* moderate-sized, enclosed in broad patches of white soft tissue, in concentric bands, often anastomozing. *Medullary rays* fine, very numerous, the distance between them less than the transverse diameter of the pores.

Indigenous in Mexico, but commonly cultivated in South India as a fuel tree and hedge plant; and grown in stations in N. India, Burma and the Andamans.

The following extract from the *Proc. of the Madras Agri.-Hort. Soc.* for 1888 gives perhaps as good an account of the many uses of this valuable tree as could be compiled:—

"As usual the society has sent on application to Ceylon, Penang and all parts of 'India, particularly the north, large quantities of the seed of this invaluable and most 'versatile tree. It is probably the most universally cultivated tree in Madras, being as 'general for hedging, and nearly as good, as the Hawthorn in England. It bears any 'amount of clipping and chopping, or worse, nibbling by sheep and goats and gnawing 'by horses and cattle. If attended to, it forms an impassable fence; if neglected, it 'grows into a noble 'bullfinch.' It sows itself and grows on all waste land, and that 'even with its roots in salt or brackish water. Single or surviving hedge plants grow 'into grand timber trees. The timber is used by the husbandman for cart-building; 'the wood is specially appreciated by the brick-maker; the leaves and twigs furnish a 'never-failing forage for the poverty-stricken feeder of milch goats; birds, beasts, and 'boys scramble for the plump arillus which encases its seeds; and in the hot weather 'when the grass is too dry to be eatable, the hungry cattle eagerly devour the 'tough pods."

The growth of the Karkapilly is very fast in suitable places, and as it coppices well, it is worth growing for fuel in such lands as those of the Madras coast. The weight of the wood is about 40 lbs. per cubic foot.

		lbs.
D 4135.	Agri-Hort. Garden, Madras (Steavenson)	40

2. **P. bigeminum**, Benth.; Fl. Br. Ind. ii. 303; Bedd. Fl. Sylv. xcvi.; Brandis For. Fl. 173; Gamble Darj. List 34; Talbot Bomb. List 87; Trimen Fl. Ceyl. ii. 132.

Vern. *Kachlora*, Kumaon; *Takpyit*, Lepcha; *Moj*, Ass.; *Kal pakku*, Tam.; *Pannivaga*, *atthaperantha*, Trav. Hills; *Kalatiya*, Cingh.

A large tree. *Wood* light brown, soft. *Pores* few, large, scanty, often divided in two. *Medullary rays* extremely fine, numerous and closely packed.

Eastern Himalaya, up to 4000 ft. in Sikkim, Assam; hills of South India from the Konkan and Kanara to Travancore, abundant in Wynaad; Kachin Hills in Burma.

A fine tree. S. E. Peal says it often reaches 6 ft. in girth, and that the wood is good for planking, battens, etc., but not easy to work (*Ind. Tea Gaz.*, 1883).

		lbs.
W 4300.	Tinnevelly (Brasier)	22

3. P. lobatum, Benth.; Fl. Br. Ind. ii. 305; Kurz For. Fl. i. 429. *Mimosa Koeringa*, Roxb. Fl. Ind. ii. 543. Vern. *Tanyin*, Burm.

An evergreen tree. *Bark* thin, greyish-brown, young trees with narrow horizontal lenticels. *Wood* (young trees) grey, moderately hard. *Pores* large, often subdivided, in rings of loose texture, very scanty, prominent on vertical sections. *Medullary rays* fine, numerous, inconspicuous.

Upper mixed forests and tropical forests of Burma.

		lbs.
B 5048.	Myaungmyo Forests, Burma	30
B 5075.	Thaungyin Forests, Burma (Cappel)	35

4. P. Saman, Benth. The Rain-tree.

A large tree. *Bark* grey. *Wood* soft, sapwood white, heartwood light brown. *Pores* scanty, moderate-sized, often subdivided, enclosed in rings of soft tissue. *Medullary rays* fine, scanty.

Introduced recently from S. America, and now largely cultivated in some parts of India.

The "Rain-tree" was much discussed a few years since, and was cultivated largely under the authority of Government. The growth is exceedingly fast, but it has not answered to expectations, as its wood is nearly worthless either as timber or fuel, and as the tree will only thrive in good soils where there is already abundance of fodder, there is no demand for its leaves and pods as food for cattle. Where the soil suits and the climate is moist, the rain-tree is useful for avenues. It is easily propagated by seed, and will grow from slips and cuttings.

		lbs.
E 3711, 3924.	Roy. Bot. Garden, Calcutta (King)	26 and 32
O 4507.	Bot. Garden, Saharanpur (Gollan)	36

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76. INGA, Willd. *I. cynometroides*, Bedd.; Fl. Br. Ind. ii. 306 (*Calliandra cynometroides*, Bedd. Fl. Sylv. t. 317), is a moderate-sized tree of the evergreen forests on the hills of Travancore and Tinnevelly at 2–4000 ft.

ORDER XLIII. ROSACEÆ.

Contains 21 genera of Indian trees, shrubs or climbers, chiefly found in the colder regions of the Himalaya and other mountain ranges. It is divided into seven Tribes, viz.—

Tribe I. Chrysobalaneæ	Parinarium, Parastemon.
" II. Pruneæ	Prunus, Maddenia, Pygeum, Prinsepia.
" III. Spiræeæ	Spiræa, Neillia.
" IV. Rubeæ	Rubus.
" V. Potentilleæ	Potentilla.
" VI. Roseæ	Rosa.

Tribe VII. Pomeæ . . . . . . Cydonia, Docynia, Eriobotrya, Pyrus, Photinia, Pourthiæa, Stranvæsia, Cratægus, Cotoneaster, Osteomeles.

The Rosaceæ are not very important in a Forest point of view, either for their products or their sylvicultural value. With few exceptions, they are plants of the hill country of very little consequence. *Prunus Puddum*, in the large Sikkim variety, is almost the only one giving a timber of value, and that for furniture only. But as fruit trees, wild or cultivated, there are many species of the greatest importance.

Except *Parinarium*, *Pygeum*, *Rosa* and *Rubus*, the structure of the woods of Rosaceæ is very uniform, being compact and consisting of small or extremely small, evenly distributed *pores*; and regular, fine to extremely fine *medullary rays*. In the four genera mentioned, the first two have considerably larger *pores*, and the other two much broader *medullary rays*. *Wood* generally close- and even-grained, white or pink to brown.

1. PARINARIUM, Juss.

Four or five species, all trees, some of them scarce. *P. Griffithianum*, Bth.; Fl. Br. Ind. ii. 310, is a tree of Tenasserim and the Andaman Islands. *P. indicum*, Bedd.; Fl. Br. Ind. ii. 311; Bedd. Fl. Sylv. t. 191, is a tree of the forests of the Wynaad at 2–3000 ft.

1. P. travancoricum, Bedd.; Fl. Br. Ind. ii. 311.

A small tree. *Wood* light red, moderately hard. *Pores* large, scanty, making pretty brown lines on a vertical section. *Medullary rays* very fine, very numerous, close and even. Regular, fine, wavy, concentric bands of light tissue.

Hills of Travancore, about 2000 ft., scarce.

		lbs.
W 4685.	Travancore (Bourdillon)	42

2. PARASTEMON, A. DC. *P. urophyllum*, A. DC; Fl. Br. Ind. ii. 312, is a shrub or small tree of Tenasserim and the Andamans.

3. PRUNUS, Linn.

Including the almond, peach, apricot, plum and cherry, cultivated trees, and two Baluchistan species, there are about 21 species in the Indian limits.

P. tomentosa, Thunb.; Fl. Br. Ind. ii. 214, is a shrub of Kashmir at 5–6000 ft. *P. triflora*, Roxb. Fl. Ind. ii. 501; Fl. Br. Ind. ii. 315; Kurz For. Fl. i. 434, is a small bushy tree of the hills of Upper Burma. *P. undulata*, Ham.; Fl. Br. Ind. ii. 316; Gamble Darj. List 35, is a small tree of the Central and Eastern Himalaya from 6–12,000 ft. and the Khasia Hills. *P. punctata*, Hook. f. and Th. is a shrub or small tree of the Khasia Hills; and *P. Jenkinsii*, Hook. f. and Th. is a small tree of Assam.

Besides the cultivated species described, the acid Cherry, *P. Cerasus*, Linn., and the sweet Cherry, *P. Avium*, Linn.; Vern. *Gilás*, *olchi*, *krusbal*, Pb. (Brandis), are sometimes cultivated in the West Himalaya.

Wood close- and even-grained, usually reddish, often scented. *Pores* small or very small. *Medullary rays* generally of two classes, fine and moderately broad. *Annual rings* marked either by a continuous line of pores or by more numerous pores in the spring wood. Almost all have a pretty silver-grain.

1. P. Amygdalus, Baill.; Fl. Br. Ind. ii. 313; Brandis For. Fl. 190. *Amygdalus communis*, Linn.; Roxb. Fl. Ind. ii. 500. The Almond. *Amandier*, Fr.; *Mandelbaum*, Germ. Vern. *Badám*, Hind.

A moderate-sized tree. *Wood* light brown, moderately hard. *Pores* very small, very numerous, uniformly distributed; large in the early part of the annual ring, which they conspicuously mark. *Medullary rays* of two classes, fine and moderately broad, numerous, regular.

Indigenous in Western Asia; occasionally cultivated in Kashmir and the Punjab.
Mathieu Fl. For. 136 gives the weight as 57 to 69 lbs. per cubic foot.
Nordlinger's Sections, vol. 1.

2. **P. persica**, Bth. and Hook. f.; Fl. Br. Ind. ii. 313; Brandis For. Fl. 191; Kurz For. Fl. i. 433; Gamble Darj. List 34. *Amygdalus persica*, Linn.; Roxb. Fl. Ind. ii. 500. The Peach. *Pêcher*, Fr.; *Pfirsichbaum*, Germ.; *Pesco*, Ital. Vern. *Ghwareshtái*, Afgh.; *Aru, aor, chinannu, beinni, beimu, rek*, Pb.; *Aru*, Hind.; *Takpo*, Lepcha.

A small tree. *Bark* grey, shining, smooth, with numerous horizontal corky lenticels divided in the middle. *Wood* red, scented, hard, close-grained; structure the same as that of *P. Amygdalus*. A pretty silver-grain.

Cultivated all over India, often run wild.
Mathieu Fl. For. 137 gives the weight as 46 lbs. per cubic foot.

		lbs.
H 4557.	Kathian, Jaunsar, 7000 ft. (Gamble)	43
O 4746.	Forest School Garden, Dehra Dún (Gamble)	47
W 4122.	Ootacamund, 7000 ft. (Gamble)	—

3. **P. armeniaca**, Linn.; Fl. Br. Ind. ii. 313; Brandis For. Fl. 191; Roxb. Fl. Ind. ii. 501. The Apricot. *Abricotier*, Fr.; *Aprikosenbaum*, Germ. Vern. *Hári, gardalu, jaldaru, zardaru, chúli, chilu, shíran, cheroli, cher kúsh, serkuji, shari*, Pb.; *Iser*, Kashmir; *Chúari, zardálu, khoobani*, Hind.; *Mishmish*, Pers.; *Chuaru*, Kumaon; *Kusmia aru*, Dotiál.

A moderate-sized deciduous tree. *Bark* dark brown, rough, with narrow longitudinal clefts. Sapwood white; heartwood greyish-brown, mottled with dark brown streaks, moderately hard. Structure the same as that of *P. Amygdalus* and *P. persica*.

Cultivated in the Western Himalaya.
The most common fruit tree about the villages of the Western Himalaya. Weight 49 lbs. per cubic foot; Mathieu, Fl. For., p. 141, gives 59 lbs. Growth moderate, 4 to 8 rings per inch of radius. Wood handsome, used for various purposes in the Punjab Hills. In Lahoul and Upper Kunawar it is the chief firewood. The fruit, fresh or dried, is extensively used for food, and an oil is extracted from the kernels which is used to burn, in cooking and for the hair.

		lbs.
H 781.	Bathri, Chamba, 3000 ft.	49
H 20.	Madhan, Simla, 6000 ft.	49
H 2876.	Matiyána, Simla, 7000 ft. (Gamble)	—

4. **P. prostrata**, Labill.; Fl. Br. Ind. ii. 213; Brandis For. Fl. 193. Vern. *Tára, ter, talle*, Pb.

A shrub. *Bark* dark greyish-brown, smooth, thin. *Wood* hard, close- and even-grained: sapwood pinkish-white; heartwood greyish-brown, streaked. *Pores* extremely small, except in the spring wood, where they are larger, and mark the *annual rings*. *Medullary rays* extremely fine and numerous, short.

Rocky places in Afghanistan; arid parts of the West Himalaya, generally above 7000 ft.

		lbs.
P 4870.	Punjab Himalaya (Elliott)	55

5. P. rufa, Wall.; Fl. Br. Ind. ii. 314; Gamble Darj. List 34. Vern. *Kamki,* Bhutia.

A small tree. *Bark* grey or greyish-brown, shining, peeling off in thin, horizontal, shining, papery but tough layers. *Wood* reddish-brown, moderately hard. *Annual rings* marked by a line of pores in the spring wood. *Pores* small, very scanty, except in the spring wood layer. *Medullary rays* of two classes, the larger fine, the smaller very fine, the latter with two or three only between the former.

Eastern Himalaya, from Nepal eastward, at 10–12,000 ft.

E 4934. Tonglo, Darjeeling, 10,000 ft. (C. G. Rogers).
E 4935. Suburkum, „ 11,000 ft. „

6. P. Puddum, Roxb.; Fl. Br. Ind. ii. 314; Brandis For. Fl. 194; Kurz For. Fl. i. 434; Gamble Darj. List 34. *P. sylvatica,* Roxb. Fl. Ind. ii. 501. Vern. *Chamiári, amalgúch, pája, pajia,* Pb.; *Paddam, páya,* Hind.; *Phaja,* Jaunsar; *Payán,* Kumaon, Garhwal; *Pangia,* Dotiál; *Kongki,* Lepcha.

A moderate-sized (in Sikkim, a large) deciduous tree. *Bark* pale brown to dark brown, shining, peeling off in thin, horizontal, shining layers. *Wood* moderately hard, scented: sapwood white; heartwood red. *Annual rings* distinctly marked by an irregular and not continuous belt of numerous pores. *Pores* small; those of the spring wood very small, frequently arranged in oblique lines intersecting the medullary rays at an angle. *Medullary rays* of two classes: numerous, very fine rays alternating with fewer, short, moderately broad rays, giving a pretty shining silver-grain.

Wild in the Himalaya, from the Indus to Assam, between 2500 and 7000 ft.; Khasia Hills; hills of Upper Burma; often cultivated.

There are two varieties of this tree in the Darjeeling hills: (1) a very big tree with crimson flowers which appear in March, and wood of size fit for large carpentry; and (2) a small or medium-sized tree with pink flowers which appear in October to November, and similar wood but small. This is the one which is common in the West Himalaya, both wild and cultivated. These two varieties require investigation; they are possibly species. Var. No. 1 has a rather different structure, viz. "larger 'pores, much subdivided, scanty; medullary rays narrower, wavy;" to it probably belong Nos. E 683, E 2363, E 2364 and E 3594.

The wood is used in the Punjab Himalaya for walking-sticks, which are made of saplings or root-suckers; in Darjeeling occasionally for furniture. It deserves to be better known, and to be more extensively used, as, at any rate, in Sikkim, it is common, and reaches a large size. It gives an abundant gum, not used. Weight, on an average, 45 lbs. per cubic foot. The seeds are strung in rosaries, and used by faqirs (U. N. Kanjilal).

		lbs.
H 46.	Nagkanda, Simla, 7000 ft.	52
H 234.	Garhwal Hills (1868)	46
E 683.	Sepoydura Forest, Darjeeling, 6000 ft. (Johnston)	42
E 2363.	Kurseong, Darjeeling, 5000 ft. (Gamble)	41
E 2364, 3594.	Tukdah Forest, Darjeeling, 5000 ft. (Gamble) . . .	48
E 1447.	Mishmi Hills (Griffith, 1836)	37

7. P. communis, Huds.; Fl. Br. Ind. ii. 315; Brandis For. Fl. 192. The Plum. *Prunier,* Fr.; *Pflaumenbaum,* Germ. Vern. *Alúcha, olchi, er, aor, gardalu,* Pb.

A moderate-sized tree. *Wood* reddish-brown, hard, very close-grained, warps and splits, structure the same as that of the last three species, but the *pores* smaller in both the spring and autumn wood, the former sometimes absent, so that the annual ring is only marked by a line.

Cultivated (or indigenous, Fl. Br. Ind.) from Garhwal to Kashmir in the Western Himalaya, at 5–7000 ft. Kuram Valley, at 7–9000 ft., almost wild (Aitchison).

Growth fast, 2 to 3 rings per inch of radius. Weight 50 lbs. per cubic foot. The wood is smooth to work, and is used in Kashmir for the skeleton of the so-called papier-maché boxes.

		lbs.
H 151.	Giri Valley, Simla, 4000 ft.	52
O 4739.	Forest School Garden, Dehra Dún (Gamble)	49

8. P. Padus, Linn.; Fl. Br. Ind. ii. 315; Brandis For. Fl. 194. The Bird Cherry. *Cerisier à grappes*, Fr.; *Ahlkirsche*, Germ. Vern. *Páras, kalakat, gidar-dák, bart, zúm, zam, zambu, jamu, chúle, dúdla, krún*, Pb.; *Jamana, jamnoi, jamoi, jamroi*, Jaunsar; *Angúrak*, Kuram.

A moderate-sized, deciduous tree, with dark, rough bark. *Wood* moderately hard: sapwood large, whitish; heartwood reddish-brown, with an unpleasant smell. *Annual rings* distinctly marked by a narrow belt of continuous, closely arranged pores. *Pores* small, scanty, in small groups. *Medullary rays* moderately broad, dark, undulating, very prominent as a handsome silver-grain on a radial section.

Himalaya, from the Indus to Sikkim, at 6–10,000 ft.; Kuram valley.

This pretty tree is common in the upper hill forests at 7–10,000 ft., especially associated with maples, *Quercus dilatata* and yew, and particularly on "tháchs" or sheep-grazing grassy glades in the fir forests. Growth rather slow. Average weight 41 lbs. per cubic foot; Mathieu Fl. For. p. 141 gives an average of 41·5 lbs. The wood has often a handsome grain, and deserves to be better known; it is scarcely ever used. The fruit is sometimes attacked by Aphids, and then takes a curious horn-like appearance, which is rather common.

		lbs.
H 916.	Hazara, 7000 ft.	38
H 22.	Matiyána, Simla, 7000 ft.	42
H 58.	Nagkanda, Simla, 8000 ft.	43

The structure of the wood of the European tree as shown in Nordlinger's Sections, vol. 1, differs a good deal. It has much more numerous, very clear *pores*, and finer, more distinct *medullary rays*.

9. P. nepalensis, Ser.; Fl. Br. Ind. ii. 316; Gamble Darj. List 34. Vern. *Bangbhalu*, Kumaon; *Likh-aru, arupatti*, Nep.; *Hlosahlot*, Lepcha.

A large tree. *Bark* blackish-grey, smooth, thin. *Wood* moderately hard, even-grained: sapwood white; heartwood reddish-brown. Structure similar to that of *P. Padus*.

Central and Eastern Himalaya from Kumaon to Bhutan, at 6–10,000 ft.; Khasia Hills at 4–6000 ft.

A common tree about Darjeeling, with verticillate upright-growing branches, coming into new leaf early in March.

		lbs.
E 696.	Rangbúl Forest, Darjeeling, 7000 ft. (Johnston) . . .	41
E 2369.	„ „ „ (Gamble)	42

No. E 5086 from the Darjeeling Hills (C. G. Rogers) is probably the wood of *P. undulata*, Ham. *Bark* grey, smooth. *Wood* light brown, structure as in *P. Padus*.

10. P. martabanica, Wall.; Fl. Br. Ind. ii. 316; Kurz For. Fl. i. 434. Vern. *Thitmanku*, Burm.

An evergreen tree. *Bark* thin, fibrous, brown. *Wood* heavy, cross-grained, red. *Pores* moderate-sized, often subdivided. *Medullary rays* fine, uniform, closely packed.

Tropical and moister upper mixed forests of the Andamans, also Tenasserim.

B 1975. Andaman Islands (Kurz, 1866).

11. P. acuminata, Wall.; Fl. Br. Ind. ii. 317; Gamble Darj. List 35. Vern. *Lali*, Nep.

A tree with thin dark bark. *Wood* reddish-brown. *Pores* small, sometimes in groups or radial lines. *Medullary rays* of two classes, numerous, very fine rays, alternating with fewer, short, broad ones, silver-grain pretty, wavy.

Eastern Himalaya and Khasia Hills at 4–7000 ft.

A useful wood, sometimes used for planking and boxes.

E 3422. Rangirúm, Darjeeling, 6500 ft. (Gamble).
E 3309. Sureil, Darjeeling, 6000 ft. (Gamble).

12. P. eburnea, Aitch.; Journ. Linn. Soc. xviii. 50.

A large shrub with silvery-white branches. *Bark* very rough, dark brown, peeling off in papery flakes. *Wood* hard, close-grained, pale reddish-brown. *Pores* extremely small, evenly distributed in the autumn wood; much larger in the spring wood, where they form a regular belt indicating the annual ring. *Medullary rays* fine to moderately broad, rather scanty, short.

Baluchistan, in the Juniper tracts, common and gregarious in thickets on stony ground between the ranges up to 9000 ft. Flowers pink (Lace). Also characteristic of open stony ground in the Kuram Valley with *P. Jacquemontii*, Hook. f. (Aitchison).

		lbs.
P 4481.	Baluchistan (Lace)	57

13. P. microcarpa, C. A. Mey.

A shrub. *Bark* very smooth, chestnut-brown, shining, with large horizontal lenticels. *Wood* white, heartwood dark brown, structure the same as that of *P. eburnea.*

Baluchistan, in the Juniper tracts, not common.

P 4480. Zarghun Range, Baluchistan (Lace).

4. MADDENIA, Hook. f. and Th. *M. himalaica*, Hook. f. and Th.; Fl. Br. Ind. ii. 318, is a small tree of the higher mountains of the Eastern Himalaya at 8–10,000 ft.

5. PYGEUM, Gaertn.

Ten species, evergreen trees or shrubs, rather scarce. *P. acuminatum*, Colebr.; Fl. Br. Ind. ii. 318; Kurz For. Fl. i. 435; Gamble Darj. List 35, is a tree of the Sikkim terai (scarce), Khasia Hills and Chittagong, with a red wood. *P. glaberrimum*, Hook. f. and *P. montanum*, Hook. f. are evergreen trees with much the same distribution, but ascending the hills to about 5000 ft. *P. Andersoni*, Hook. f.; Fl. Br. Ind. ii. 320, is a rigid shrub found on the summit of Parasnáth Hill in Chota Nagpore at 4000 ft. *P. arboreum*, Endl. and *P. persimile*, Kurz, are trees of Tenasserim, the former extending to the Martaban Hills at 3–5000 ft. *P. Gardneri*, Hook. f.; Fl. Br. Ind. ii. 321; Talbot Bomb. List 87, is a large tree of the Western Gháts from Mahabaleshwar to the Nilgiris.

1. P. Wightianum, Blume; Fl. Br. Ind. ii. 319; Talbot Bomb. List 87; Trimen Fl. Ceyl. ii. 134. *P. ceylanicum*, Bedd. Fl. Sylv. t. 59. Vern. *Palangkacchi*, Tam.; *Nay kambagam, shetturi*, Mal.; *Mutta kongu, rettiyan*, Trav. Hills.

A large tree. *Bark* rough, pale brown. *Wood* red, hard. *Pores* moderately large to large, scanty, single or in radial or oblique strings, unevenly distributed, conspicuous on a vertical section. *Medullary rays* moderately broad, short, dark.

Western Gháts in evergreen forests, from N. Kanara to Travancore up to 4000 ft.; Anamalai, Shevaroy and Pulney Hills; hill forests of Ceylon.

Beddome says this is an immense tree with very large buttresses, often with a girth of 20 ft. and an enormous spreading head. He says it smells strongly of prussic acid. Bourdillon gives W = 44 lbs., P = 622.

		lbs.
W 4672.	Travancore (Bourdillon)	41

2. P. zeylanicum, Gaertn.; Fl. Br. Ind. ii. 321; Trimen Fl. Ceyl. ii. 135. Vern. *Galu-mora*, Cingh.

A large tree. *Bark* grey, smooth. *Wood* light red or yellowish, hard, close-grained. *Pores* moderate-sized, often subdivided, scanty. *Medullary rays* fine, numerous, not conspicuous.

Moist low country of Ceylon.

	lbs.
No. 28, Ceylon Collection (A. Mendis)	65

6. PRINSEPIA, Royle.

1. P. utilis, Royle; Fl. Br. Ind. ii. 323; Brandis For. Fl. 196. Vern. *Bhekal, bekkra, karanga, kanitri, kongtri, kúsht, kúkis, kúktis*, Hind.; *Gurinda*, Hazara; *Tatúa, phulwara*, Rajaori; *Jinti*, Chenab; *Bekling*, Kunawar; *Cherara, dhatela, jhatela*, Kumaon or Garhwal; *Bhekkoi, bhek*, Jaunsar.

A deciduous, thorny shrub. *Bark* thin, brown, peeling off in small vertical flakes; under-bark orange. *Wood* red, very hard and compact, close and even-grained, but much liable to split. *Annual rings* marked by a narrow continuous belt or line of small pores; the pores outside this belt very small. The *pores* are sometimes filled with a white substance. *Medullary rays* of various sizes from very fine to almost moderately broad, short, numerous. Pith large.

Outer Himalaya, from Hazara to Bhutan at 2–9000 ft.; Khasia Hills; naturalized in the Nilgiris.

A well-known shrub, very common on dry hillsides near any small spring or water-course. It owes its growth usually to its thorns which protect it, and it apparently is not eaten by goats. The fruit is like a sloe, but has the style near the base. Growth slow, 12 rings per inch of radius. Weight 69 lbs. per cubic foot. The wood is only used for fuel and occasionally for walking-sticks. An oil is expressed from the seeds, and is used for food and for burning.

		lbs.
H 49.	Nagkanda, Simla, 8000 ft.	69
H 2868.	" " " (Gamble)	—
H 4786.	Kathian, Jaunsar, 7000 ft. "	50 (young)
	Nordlinger's Sections, vol. 8.	

7. SPIRÆA, Linn.

Contains eleven species found in the Himalaya, chiefly at elevations above 6000 ft. They include both herbs, such as the "Meadow Sweet" found in Kashmir; and shrubs, few of which attain any size. The two described are the most important.

1. S. sorbifolia, Linn.; Fl. Br. Ind. ii. 324. *S. Lindleyana*, Wall. Vern. *Sarbashtai, kikri, batu*, Pb.; *Latkar, lotkar*, Jaunsar.

A shrub. Bark reddish-grey, covered closely with rough rounded lenticels. *Wood* hard, compact, even-grained, dark yellowish-brown. *Annual rings* marked by a coloured belt. *Pores* small, scanty, evenly distributed. *Medullary rays* moderately broad, conspicuous and clear, short, not numerous.

West Himalaya, from the Sutlej to Kumaon, above 7000 ft.; Kuran Valley at 7–9000 ft. in water channels.

A very pretty shrub, well known in gardens in Europe. It has pinnate leaves and large branched cymose panicles of white flowers at the ends of the branches. It affects hill-sides on the cooler aspects, and ravines, in company with *Desmodium tiliæfolium*, *Prinsepia utilis* and similar shrubs. Growth moderate, 12 rings per inch of radius.

		lbs.
H 81.	Simla, 7000 ft.	49
H 3014.	Hattu Forest, Simla, 8000 ft. (Gamble)	—
H 4781.	Kulni parao, Tehri-Garhwal, 8000 ft. (Gamble) . . .	51

2. **S. canescens,** Don; Fl. Br. Ind. ii. 325. Vern. *Chaku, taku,* Simla; *Bhuti,* Kumaon; *Katmatialna,* Garhwal; *Takoi, chakroi,* Jaunsar.

A small rather twiggy shrub. *Wood* with structure similar to that of *S. sorbifolia.*

West Himalaya, from Murree to Kumaon, at 6–8000 ft.

Growth moderate, 12 rings per inch of radius. A conspicuous shrub, which is found chiefly on open hill-sides as a stiff bush in company with *Indigofera heterantha, Berberis,* etc. It is very handsome when in flower in the spring, having curved branches with white corymbs of hawthorn-like flowers on one side.

		lbs.
H 159.	Simla, 7000 ft.	47
H 2827.	Mahasu, Simla, 8000 ft. (Gamble)	—

8. NEILLIA, Don. Two species, both shrubs of no importance, viz. *N. thyrsiflora,* Don, and *N. rubiflora,* Don; Fl. Br. Ind. ii. Add.; Gamble Darj. List 35; Vern. *Pukshioung,* Lepcha, both very similar and common about Darjeeling at 7000 ft.

9. RUBUS, Linn.

Contains 40 species of erect, trailing or climbing, generally thorny shrubs. Many species are known on account of their edible fruits, the best of which is perhaps *R. ellipticus. R. fruticosus,* Linn.; Fl. Br. Ind. ii. 337; Brandis For. Fl. 197; the Blackberry or Bramble; Vern. *Ankri, alish, kanachi, chench, pakhána,* Pb., is found in Afghanistan, the Salt Range and the Punjab Himalaya as far east as the Ravi. *R. rosæfolius,* Sm.; Fl. Br. Ind. ii. 341; Kurz For. Fl. i. 439; Gamble Darj. List 36, is a small shrub found in the Himalaya from Kumaon to Sikkim, in the Khasia Hills and in the hills of Burma. It has a large, red, edible fruit, which is sold in the bazar in Darjeeling. *R. biflorus,* Buch.; Fl. Br. Ind. i. 338; Brandis For. Fl. 198; Vern. *Chánch, kantauch, khaniára,* Kashmir; *Karer, akhreri, akhe,* Ravi; *Dher,* Simla; *Hinsola,* Garhwal, is a white-stemmed shrub of the Himalaya from Hazara to Bhutan. *R. niveus,* Wall.; Fl. Br. Ind. ii. 335; Brandis For. Fl. 199; Gamble Darj. List 35; Vern. *Kalga,* Sutlej; *Bhera,* Jaunsar, has the same distribution, and is a common undershrub in the fir and oak forests at 8–10,000 ft., with a red fruit, very like the raspberry. *R. moluccanus,* Linn.; Fl. Br. Ind. ii. 330; Kurz For. Fl. i. 439; Gamble Darj. List 35; Talbot Bomb. List 88; Trimen Fl. Ceyl. ii. 136; Vern. *Bipemkanta,* Nep.; *Sufok-ji,* Lepcha; *Wel-buté,* Cingh., is a large shrub with simple, rugose leaves and red edible fruit, found in the East Himalaya and down to S. India, Ceylon and Burma. *R. racemosus,* Roxb., and two other species occur on the Nilgiris. There are many other interesting species, but too small and too unimportant for mention here.

1. **R. ellipticus,** Smith; Fl. Br. Ind. ii. 336; Gamble Darj. List 36; Talbot Bomb. List 88; Trimen Fl. Ceyl. ii. 137. *R. flavus,* Ham.; Brandis For Fl. 197; Kurz For. Fl. i. 438. *R. Gowreephul,* Roxb. Fl. Ind. ii. 517. Vern. *Akhi, ankri, kunáchi, guracha, pukana, achu,* Pb.; *Hinsau, anchu,* Jaunsar; *Esar, aisalu, hinsra, hinshalu, hisalu,* Kumaon; *Ashiálo,* Dotiál; *Tolu aselu, escalu, cesi,* Nep.; *Kashyem,* Lepcha.

A large thorny shrub. *Bark* brown, moderately hard. *Wood* light-brown. *Pores* small. *Medullary rays* short, very broad and moderately broad.

Himalaya, from the Indus to Bhutan, between 1500 and 8000 ft.; Khasia Hills and Assam; Ghâts of Bombay and Madras; hills of Burma; hill region of Ceylon: in fact, in all Indian hill regions over 4000 ft.

The fruit is yellow and with the flavour of the raspberry; it is commonly eaten and made into preserves in the Himalaya, and is certainly one of the best of the wild fruits of India. I cannot at all agree with Trimen in calling it "scarcely edible," for I have eaten it in many parts of India, and even on the hills of Ceylon.

E 2367. Tukdah Forest, Darjeeling, 5000 ft. (Gamble).

2. **R. lasiocarpus,** Smith; Fl. Br. Ind. ii. 339; Brandis For. Fl. 198; Kurz For. Fl. i. 439; Gamble Darj. List 36; Talbot Bomb. List 88; Trimen Fl. Ceyl. ii. 138. Vern. *Gunacha, pukana,* Hazara; *Kandiári, kharmuch, súrganch,* Kashmir; *Túlanch,* Chenab; *Niú, kalliachi,* Beas; *Klenchu, galka,* Simla; *Kalga,* Sutlej; *Kalawar, kala hisalu,* Kumaon; *Kala aselu,* Nep.; *Kajutalam,* Lepcha; *Gariphal,* Mar.

A straggling shrub. *Bark* smooth. *Wood*-structure similar to that of *R. ellipticus*.

Himalaya, Khasia Hills, Burma, South India and Ceylon.
The fruit has a glaucous blue-black colour; it is small, but of good flavour.
E 2368. Tukdah Forest, Darjeeling, 5000 ft. (Gamble).

3. **R. lineatus,** Reinw.; Fl. Br. Ind. ii. 333; Gamble Darj. List 36. Vern. *Gempé aselu*, Nep.

A large thornless shrub. *Bark* red, peeling off in papery flakes. *Wood* yellowish-brown, in structure resembling that of *R. ellipticus*.

Sikkim Himalaya, at 6–9000 ft., gregarious on hill-sides in the oak forest region.
The stems are used to make fences. It has a red, edible fruit.
E 3307. Darjeeling, 7000 ft. (Gamble).
E 3383. Senchal, Darjeeling, 8000 ft. (Gamble).

4. **R. paniculatus,** Sm.; Fl. Br. Ind. ii. 329; Brandis For. Fl. 196; Gamble Darj. List 36. Vern. *Kala akhi*, Kangra; *Anchu, karailo, katria, pattarola, kale hisalu*, Hind.; *Pandroi, kala anchu*, Jaunsar; *Naming*, Lepcha.

A climbing shrub. *Bark* brown, soft, thick. *Wood* brown. *Pores* large, many. *Medullary rays* broad.

Throughout the Himalaya at 3–8000 ft.; Khasia Hills.
This species has simple leaves, white beneath, and a black blackberry-like fruit.
E 3361. Darjeeling, 6500 ft. (Gamble).

10. POTENTILLA, Linn.

1. **P. fruticosa,** Linn.; Fl. Br. Ind. ii. 347; Gamble Darj. List 36.

A small rigid shrub. *Wood* yellowish, hard. *Annual rings* marked by the absence of pores in the autumn wood, *pores* in the rest fine, numerous. *Medullary rays* fine, numerous, rather irregular.

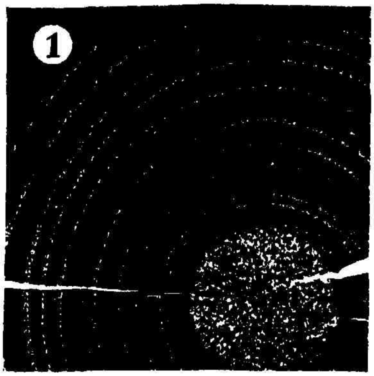
Himalaya from Kashmir to Sikkim at 8–12,000 ft., usually on rocks, often in company with the small Rhododendrons.
Nordlinger's Sections, vol. 11.

11. ROSA, Linn.

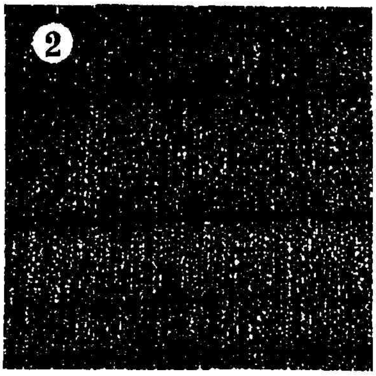
Contains about eleven species without including those cultivated in India, full account of which is given in Brandis' "Forest Flora," and referred to in the Fl. Br. Ind. ii. 363. *Rosa involucrata*, Roxb. Fl. Ind. ii. 513; Fl. Br. Ind. ii. 365; Kurz For. Fl. i. 440; Vern. *Kúa*, Beng., is a sub-scandent shrub of the banks of streams in the Gangetic plain, westward to Mount Abu and eastward to Burma. It is also found in Gorakhpur and in the streams of Behar and Chota Nagpore. *R. Eglanteria*, Linn.; Fl. Br. Ind. ii. 366 (*R. lutea*, Mill.; Brandis For. Fl. 201), is a shrub of the arid parts of the inner Himalaya, with yellow flowers. *R. Webbiana*, Wall.; Fl. Br. Ind. ii. 366; Brandis For. Fl. 202; Vern. *Kantián, shingári*, Hazara; *Shikand, shawali, manayar, brazen*, Chenab; *Chúa*, Lahoul; *Sia*, Ladak, Piti; *Ringyal*, Kanawar, is a pink-flowered erect shrub of the same region. Thomson says that at Wandla, in the Upper Indus, it becomes a dense almost spherical bush, 15 ft. high, the foliage almost concealed by the bright red flowers ("W. Him. and Tibet," p. 386). *R. anserinæfolia*, Boiss.; Fl. Br. Ind. ii. 365, is a common, wild and cultivated, white-flowered rose of Afghanistan. *R. longicuspis*, Bertol.; Fl. Br. Ind. ii. 367, is a climber of the Khasia Hills at 2–5000 ft. *R. gigantea*, Collett is a very fine large-flowered rose of Manipur and the Shan Hills at 4–5000 ft., with thick stems, climbing extensively (Journ. Linn. Soc. xxviii. 55, t. 9). *R. Collettii*, Crépin; Jour. Linn. Soc. xxviii. 56, t. 10, is also a rose of the Shan Hills at 3–4000 ft., along streams. *R. Ecæ*, Aitch. in Journ. Linn. Soc. xviii. 54, is a small and common shrub in the Kuram Valley.

1. **R. moschata,** Mill.; Fl. Br. Ind. ii. 367; Brandis For. Fl. 201. Vern. *Kuji, kujei, karer, yál*, N.-W. Him.; *Phulwari, chal*, Kashmir; *Kwia, kwinda, kunja*, Kumaon; *Kuju*, Garhwal; *Kujoi*, Jaunsar.

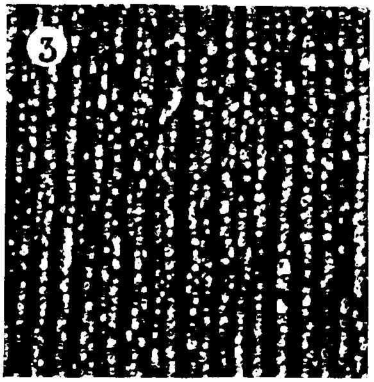
VII.



ROSA MACROPHYLLA.

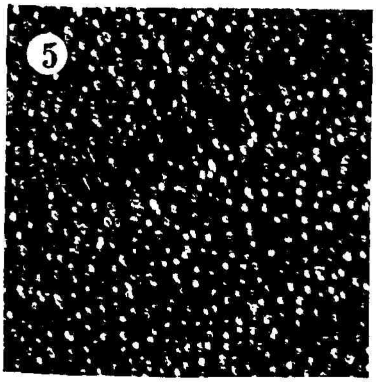


BUCKLANDIA POPULNEA.

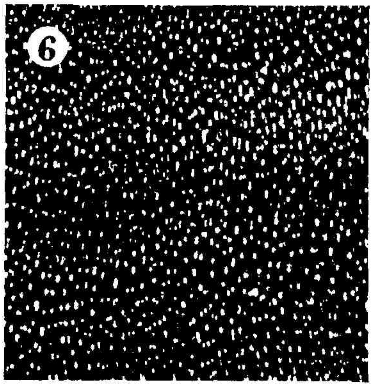


CARALLIA INTEGERRIMA.

ANOGEISSUS LATIFOLIA.



TERMINALIA BELERICA.



TERMINALIA CHEBULA.

(Magnified 3½ times.)

A large, thorny, climbing shrub. *Bark* greyish-brown. *Wood* moderately hard, porous. *Annual rings* marked by a continuous line of large pores in the spring wood, the pores in the autumn wood being scanty and small. *Medullary rays* broad to very broad.

West Himalaya, from Afghanistan to Nepal, ascending to 11,000 ft., according to the books, but I do not think I ever saw it at much over 7000 ft., and it prefers 4-6000 ft.

A tall climber, very sweet scented, and very ornamental when in flower in May and June. It is characteristic of open hill-sides among bushes at 4-6000 ft., and occasionally but rarely comes into the forests. Flowers white. Growth slow, 15 rings per inch of radius. The leaves are attacked by the same fungus that damages cultivated and wild roses in Europe, *Phragmidium subcorticium*, Schrad.

H 115. Bhajji, Simla, 5000 ft.

2. **R. sericea,** Lindl.; Fl. Br. Ind. ii. 367; Brandis For. Fl. 202; Gamble Darj. List 36. Vern. *Chapalu*, Byans; *Rangyal*, Sutlej.

A thorny shrub. *Bark* greyish-brown, peeling off in papery flakes. *Wood* very hard, darkening on exposure. *Annual rings* marked by a continuous line of very small pores in the spring wood, the pores in the autumn wood being extremely small. *Medullary rays* short, moderately broad to broad, prominent.

Himalaya, from the Sutlej to Bhutan, at 9-14,000 ft., chiefly on peaks and ridges associated with *Rhododendron campanulatum* and under the "Kharshu" oak.

Growth slow, 18 rings per inch of radius. Flowers white with four petals, very pretty.

H 4462. Balcha, Tehri-Garhwal, 9000 ft. (Gamble).
E 2366. Suburkum, Darjeeling, 11,000 ft. „

3. **R. macrophylla,** Lindl.; Fl. Br. Ind. ii. 366; Brandis For. Fl. 203. Vern. *Guláb, ban-guláb*, Hind.; *Jikjik*, Chenab; *Akhiári*, Ravi; *Breri, bankoi*, Simla; *Bhaunra kujoi*, Jaunsar; *Triphula*, Kumaon; *Dand kúnju*, Garhwal; *Dand kunenli*, Dotiál.

A thorny shrub. *Bark* blackish-brown, peeling off in thin papery flakes. *Wood* light reddish-brown, hard and compact. *Annual rings* marked by a belt of numerous small pores in the spring wood; *pores* in the rest of the wood extremely small. *Medullary rays* moderately broad to broad, prominent, giving a pretty silver-grain. Pith large.

Himalaya, from the Indus to Sikkim, between 3500 and 10,000 ft.

This pretty shrub prefers the undergrowth of the forests of fir, oak, etc., at about 7-8000 ft., where its pink flowers are very conspicuous. The leaves are often covered with a fungus, *Puccinia Rosæ*, Barcl. Growth slow, 13 rings per inch of radius. Weight 57 lbs. per cubic foot. Flowers pink.

		lbs.
H 50.	Nagkanda, Simla, 8000 ft.	—
H 2872.	„ „ „ (Gamble)	55
H 2847.	Mahasu, Simla „ „	59
H 4455.	Balcha, Tehri-Garhwal, 9000 ft. (Gamble)	61

Nordlinger's Sections, vol. 8 (Tab. VII. 1).

4. **R. Leschenaultiana,** W. and A.; Fl. Br. Ind. ii. 368.

A large climber, often hollow in the centre. *Bark* purple-red, papery, peeling off in flakes. *Wood* reddish-brown, porous, soft. *Pores* large and moderate-sized, evenly distributed between the very broad *medullary rays*.

Hills of South India, above 5000 ft.; very common in the sholas around Ootacamund.

W 3801, 4184. Fairlawns, Ootacamund, 7000 ft. (Gamble).

12. CYDONIA, Tourn.

1. C. vulgaris, Pers.; Fl. Br. Ind. ii. 369. *Pyrus Cydonia*, Roxb. Fl. Ind. ii. 511; Brandis For. Fl. 205. The Quince. *Coignassier*, Fr.; *Quitte*, Germ. Vern. *Bihi*, N. Ind.; *Bamtsúnt*, *bumsútu*, Kashmir.

A small tree. *Wood* light brown, soft, even-grained. *Pores* very small, evenly distributed. *Medullary rays* fine, short, numerous, regular. *Annual rings* marked by a line.

Cultivated in the West Himalaya, the Punjab and Baluchistan; often comes up self-sown.

Nordlinger's Sections, vol. 2.

13. DOCYNIA, Dcne.

Two species. *D. Hookeriana*, Dcne.; Fl. Br. Ind. ii. 369, is a small tree of the Khasia Hills at 5000 ft.

1. D. indica, Dcne.; Fl. Br. Ind. ii. 369; Gamble Darj. List 36. *Pyrus indica*, Wall.; Roxb. Fl. Ind. ii. 511; Kurz For. Fl. i. 441. Vern. *Mehul*, *passy*, Nep.; *Li*, Lepcha; *Sopho*, Khasia.

A small tree. *Bark* ½ in. thick, greyish-brown, shining, splitting off in irregular flakes and leaving a rough under-surface. *Wood* light brown, with an irregular purple-brown heartwood, hard, close, and even-grained. *Pores* very small, more numerous in the spring wood. *Medullary rays* fine, very numerous. *Annual rings* marked by a line.

North-East Himalaya in Nepal, Sikkim and Bhutan at 4–6000 ft.; Khasia Hills, 6000 ft.; hills of Upper Burma.

A pretty tree, the young leaves very like those of the Hawthorn, the older ones woolly. The growth is average, 6 rings per inch of radius. The fruit is edible.

E 3411. Dumsong Forests, Darjeeling (Gamble).

14. ERIOBOTRYA, Lindl.

About ten species, one of which, the Loquat, is an introduced tree. *E. Hookeriana*, Dcne.; Fl. Br. Ind. ii. 371, is a small tree of the Sikkim and Bhutan Himalaya at 4–8000 ft. *E. bengalensis*, Hook. f.; Fl. Br. Ind. ii. 371 (*Mespilus bengalensis*, Roxb. Fl. Ind. ii. 510), is also a tree of the Sikkim Himalaya at 4000 ft., the Khasia Hills, Chittagong and Burma, of considerable size. *E. angustissima*, Hook. f.; Fl. Br. Ind. ii. 372, is a shrub which forms, along river-banks in the Khasia Hills, a fastigiate brushwood (Hook. f. *l.c.*). *E. macrocarpa*, Kurz For. Fl. i. 443, is an evergreen tree found on the slopes of Kambala Hill in the Pegu Yoma at 2–3000 ft.

1. E. dubia, Dcne.; Fl. Br. Ind. ii. 371; Gamble Darj. Dist 36. Vern. *Berkúng*, Lepcha.

A small tree. *Bark* light brown, ⅙ in. thick. *Wood* white, soft, even-grained. *Pores* very small. *Medullary rays* of two classes, numerous very fine rays closely packed between fewer moderately broad rays.

East Himalaya, at 5–6000 ft., common in forests about Dumsong, British Bhutan.

Weight 46 lbs. per cubic foot.

E 2365, 3664. Rangbúl, Darjeeling, 7000 ft. (Gamble).

2. E. petiolata, Hook. f.; Fl. Br. Ind. ii. 372; Gamble Darj. List 36. Vern. *Mihul*, *mya*, Nep.; *Yelnyo*, Lepcha.

A moderate-sized evergreen tree. *Bark* greyish-brown, ⅓ in. thick. *Wood* reddish-brown, compact, hard, apt to warp slightly. *Pores* small

and very small. *Medullary rays* fine and very fine, very numerous, prominent on a radial section.

East Himalaya, in Sikkim and Bhutan, 6500 to 8000 ft.; common about Darjeeling.

A handsome tree with good wood, but not used. Aikin, describing Wallich's specimens, gives the rate of growth at 8·4 rings per inch; our specimens show 10 rings.

		lbs.
E 366.	Rangbúl, Darjeeling, 7000 ft. (Johnston)	58
E 3109.	Darjeeling, 7000 ft. (Gamble)	57
E 3335.	Rangirúm, Darjeeling, 6000 ft. (Gamble)	—

3. **E. japonica**, Lindl.; Fl. Br. Ind. ii. 372; Brandis For. Fl. 575. *Mespilus japonica*, Banks; Roxb. Fl. Ind. ii. 510. The Loquat.

A tree. *Bark* thin, dark grey. *Wood* pink, hard, close-grained. *Pores* very small, very numerous, evenly distributed. *Medullary rays* very fine, regular, rather short. *Annual rings* faintly marked by a line. A pretty silver-grain.

Indigenous in China and Japan. Cultivated in Northern India especially, elsewhere occasionally: the fruit of Saharanpur is especially in repute.

An excellent fruit when carefully grown, and an ornamental tree. The wood is an excellent one, and would do well as a substitute for pear for rulers and drawing materials.

		lbs.
O 4740.	Forest School Garden, Dehra Dún (Gamble)	55
	Nordlinger's Sections, vol. 5.	

15. PYRUS, Linn.

Contains 22 species, all found in the Himalaya and Khasia Hills, two only extending southward to Burma. The genus is divided into 5 sections: *Malus*, 3 species; *Pyrus*, 4 species; *Aria*, 2 species; *Sorbus*, 5 species; and *Micromeles*, 8 species.

In the section *Malus*, besides *P. baccata*, Linn., and the apple, *R. sikkimensis*, Hook. f.; Fl. Br. Ind. ii. 373, is found in the Sikkim Himalaya.

In the section *Pyrus*, besides *P. Pashia*, Ham., and the pear, *P. Kumaoni*, Dcne.; Fl. Br. Ind. ii. 374; Brandis For. Fl. 204, and *P. Jacquemontiana*, Dcne.; Fl. Br. Ind. ii. 374; Brandis For. Fl. 205, are found in the Western Himalaya; they much resemble *P. Pashia*.

In the section *Aria*, two species only occur; they are here described.

In the section *Sorbus*, besides *P. foliolosa* and *P. Aucuparia*, *P. microphylla*, Wall., *P. Wallichii*, Hook. f., and *P. insignis*, Hook. f., are found in the Sikkim Himalaya.

In the section *Micromeles*, *P. Griffithii*, Dcne., *P. rhamnoides*, Dcne., and *P. Thomsoni*, King, are described from high elevations in the Sikkim Himalaya; *P. ferruginea*, Hook. f., from Bhutan; and 4 species: *P. khasiana*, Dcne., *P. granulosa*, Bertol. (Vern. *Dingsopha*, Khasia), *P. polycarpa*, Hook. f., and *P. cuspidata*, Bertol., from the Khasia Hills.

Wood compact and close-grained, marked by very small evenly distributed *pores* and fine *medullary rays*. The wood of the Pears (sections *Pyrus* and *Malus*) warps and cracks, whereas that of the trees of sections *Sorbus* and *Aria* seasons better.

1. **P. Malus**, Linn.; Fl. Br. Ind. ii. 373; Roxb. Fl. Ind. ii. 511; Brandis For. Fl. 205. The Apple. *Pommier*, Fr.; *Apfelbaum*, Germ.; *Melo*, Ital. Vern. *Shewa*, Afgh.; *Shú*, *sho*, *sun*, *seo*, *chúnt*, *khajir*, *bisír*, *palu*, Pb. Him.; *Kúshú*, Ladak; *Seo*, *seb*, Hind.

A moderate-sized tree. *Bark* brown, often shining. *Wood* reddish-brown, soft, close- and even-grained. *Pores* small, numerous, evenly distributed. *Medullary rays* numerous, fine, long. *Annual rings* marked by a line.

between 5000 and 9000 ft. (Brandis); cultivated in Sind, the Punjab and other parts of N. India, as well as in the Himalaya and the hills of S. India.

Nordlinger's Sections, vol. 1.

Hough's American Woods, vol. ii. No. 30.

2. **P. baccata**, Linn.; Fl. Br. Ind. ii. 373; Brandis For. Fl. 205. The Siberian Crab. Vern. *Ban mehal, gwálam*, Hind.; *Baror, liú, lhijo, katsbal, líwar*, Pb.; *Rutripúli*, Byans.

A small tree with grey bark. *Wood* white, with pale-brown heartwood, warps considerably. Structure similar to that of *P. Pashia*, but medullary rays slightly broader.

Himalaya, from the Indus to Bhutan, at 6–11,000 ft.; Khasia Hills.

Duthie says it is plentiful in the Kumaon Hills. Growth slow, 12 rings per inch of radius. The fruit is edible.

		lbs.
E 967.	Chumbi Valley, Tibet, about 10,000 ft. (Schlich)	53

3. **P. communis**, Linn.; Fl. Br. Ind. ii. 374; Roxb. Fl. Ind. ii. 510; Brandis For. Fl. 203. The Pear. *Poirier*, Fr.; *Birnbaum*, Germ.; *Pero*, Ital. Vern. *Tang, batang, batank, nák, sunkeint, charkeint, li, shegúl*, Pb. Him.; *Nashpáti, nák*, Hind.

A small tree. *Bark* brown, smooth. *Wood* reddish-yellow or pink, soft, close- and even-grained; structure the same as that of *P. Malus*, but the pores slightly smaller.

Indigenous in S.-E. Europe, extending eastwards to Kashmir probably (Brandis). Cultivated throughout the Himalaya as well as on the Nilgiris, at Bangalore and elsewhere in South India.

Indian pears are usually only good for baking, but excellent ones for that purpose are produced at such places as Mussoorie and in Kumaon. Good eating pears, but small, are grown in S. India. In Europe the wood is prized for engraving and turning, but especially for drawing implements like T-squares, set squares, etc. Mathieu Fl. For. 169 gives the weight 44 to 52 lbs.

Nordlinger's Sections, vol. 1.

Hough's "American Woods," vol. iii. No. 57.

4. **P. Pashia**, Ham.; Fl. Br. Ind. ii. 374; Kurz For. Fl. i. 441; Gamble Darj. List 37. *P. variolosa*, Wall.; Brandis For. Fl. 204, 575. Vern. *Tang, batangi, keint, shindar, katúri, kíthu, ku, shegúl*, Pb.; *Kaint*, Jaunsar; *Mehal, mol*, Hind.; *Melu, mel*, Kumaon; *Mohál, mehel, mahol*, Garhwal; *Passi*, Nep.; *Li*, Lepcha.

A moderate-sized deciduous tree. *Bark* dark brown, exfoliating in small rectangular scales. *Wood* light reddish-brown, hard, close- and even-grained, cracks and warps. *Annual rings* marked by a dark line. *Pores* very small, evenly distributed. *Medullary rays* very fine and very numerous, uniform and equidistant.

Outer Himalaya, from the Indus to Bhutan, at 2–8000 ft.

A common tree in places in the Western Himalaya, where it is found on grassy lands in company with Rhododendron and Bán oak, also lower down with Chir pine; and in the Dehra Dún it is a common tree in ravines, conspicuous when in blossom in the winter. In the Eastern Himalaya it is scarce, and I only know of one tree in Darjeeling District, close to the Tasingthong monastery near the Sikkim frontier.

Growth moderate, 8 rings per inch of radius. Weight 47 lbs. per cubic foot. The wood is used for walking-sticks, combs, tobacco-pipes and similar purposes, and for fuel. The fruit is only eaten when half rotten, like the Medlar, but even then is not sweet.

The leaves are attacked by the fungus *Gymnosporangium Cunninghamianum*, Barcl., whose alternate generation is on the Himalayan Cypress. Another species also is found on it, *G. clavariæforme*, Jacq., whose alternate generation is probably on the Juniper.

		lbs.
H 3185.	Dungagalli, Hazara, 7000 ft. (Wild)	—
H 23.	Madhan, Simla, 6000 ft.	47
H 236.	Garhwal Hills (1868)	—

5. **P. lanata,** Don; Fl. Br. Ind. ii. 375; Gamble Darj. List 37. *P. Aria,* Ehrh.; Brandis For. Fl. 206. Vern. *Gún palos,* Afg.; *Doda, chola, chilana, maila, paltu, amal, ban pála, kanghi, thánki, morphal,* Pb.; *Galion, máuli, paltu, ban palti,* Hind.; *Bhempli, marpól,* Sutlej; *Pahi,* Jaunsar; *Singka,* Bhutia.

A moderate-sized deciduous tree. *Bark* dark brown. *Wood* white, moderately hard, close- and even-grained, seasons well. *Annual rings* marked by a narrow belt without pores, on the outside of each ring. *Pores* very small, most numerous in the spring wood. *Medullary rays* fine, numerous.

Himalaya, from the Indus to Bhutan, at 5-10,000 ft.

A common tree in the Himalaya, both in the West, where it affects grassy "tháchs" with Maples and Bird-cherry at 8-10,000 ft., and in the Sikkim Hills, where it grows with Rhododendron. Aitchison says it is found in the forests of the Kuram Valley, and its fruit, called *Amlok,* is eagerly sought by shepherds.

Growth slow, 22 rings per inch of radius. Weight 40 to 47 lbs. per cubic foot; Mathieu gives 46 to 58 lbs. The wood might be useful for boxes and other purposes for which a close and even-grained wood is required. Fruit large, eaten when half rotten, like that of the Medlar (*P. germanica,* Ldl.); leaves white beneath.

		lbs.
H 64.	Nagkanda, Simla, 8000 ft.	47
H 2887.	„ „ „ (Gamble)	40
H 3186.	Dungagalli, Hazara, 7000 ft. (Wild)	—

6. **P. vestita,** Wall.; Fl. Br. Ind. ii. 375; Gamble Darj. List 37. Vern. *Mayhell, gúhor,* Nep.; *Tungru,* Lepcha; *Naibel,* Byáns.

A deciduous tree. *Wood* reddish with brown streaks, moderately hard. *Annual rings* distinct. *Pores* very small. *Medullary rays* fine, numerous, not distinct.

Eastern Himalaya, at 8-10,000 ft.

Growth slow, 20 rings per inch of radius. Fruit edible, leaves very woolly.

		lbs.
E 380.	Tonglo, Darjeeling, 10,000 ft. (Johnston)	44

7. **P. Aucuparia,** Gaertn.; Fl. Br. Ind. ii. 375. The Mountain Ash. *Sorbier des oiseleurs,* Fr.; *Vogelbeerbaum,* Germ. Vern. *Bhan,* Upper Chenab.

A small tree. *Bark* grey, smooth. *Wood* yellowish-white, very close- and even-grained, soft. *Pores* very small, very numerous, evenly distributed. *Medullary rays* very fine and numerous, rather short. *Annual rings* marked by a line. Occasional medullary patches.

Western Himalaya, from Kashmir to Kumaon, at 11-13,000 ft.; westwards to Europe.

Only found at very high levels, though it has been collected on Hattu near Simla. Mathieu Fl. For. 183 gives the weight at 43 to 46 lbs. per cubic foot.

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8. **P. foliolosa,** Wall.; Fl. Br. Ind. ii. 376; Brandis For. Fl. 207; Gamble Darj. List 37. Vern. *Kharsani,* Nep.; *Martili,* Byáns; *Rangrok,* Sutlej.

A shrub or small tree. *Wood* white, with small, darker-coloured heartwood. *Annual rings* distinct. *Pores* very small, more numerous in the spring wood. *Medullary rays* extremely fine, very numerous. Occasionally medullary patches.

Eastern Himalaya, at 7-10,000 ft.

Growth slow, 23 rings per inch of radius.

		lbs.
H 4777.	Rikshin, Tehri-Garhwal, 10,000 ft. (Gamble)	56
E 378, 3404.	Tonglo, Darjeeling, 10,000 ft. (Johnston, Gamble). .	45

9. **P. ursina**, Wall.; Brandis For. Fl. 206. *P. foliolosa*, Wall.; Fl. Br. Ind. ii. 376 (in part). Vern. *Súlia, húlia*, Pb.; *Wampu litsi*, Lahoul.

A small tree with smooth, reddish- or yellowish-grey *bark*, peeling off in horizontal papery strips. *Wood* white, with a small, brown heartwood. Structure similar to that of *P. foliolosa*.

Himalaya, from the Indus to Sikkim, between 6000 and 12,000 ft.
Growth slow, 32 rings per inch of radius.

		lbs.
H 134.	Lahoul, 10,000 ft. (Rev. Mr. Heyde)	—
H 3020.	Hattu, Simla, 10,000 ft. (Gamble)	54

10. **P. Wallichii**, Hook. f.; Fl. Br. Ind. ii. 376.

A small tree. *Bark* greyish-brown. *Wood* brown, moderately hard. *Pores* numerous, small to moderate-sized, fewer in the autumn wood, thus marking the *annual rings*. *Medullary rays* very fine, very numerous, indistinct. Medullary patches few.

Central and Eastern Himalaya in Nepal and Sikkim, 6–9000 ft.

E 3633. Goompahar, Darjeeling, 7000 ft. (Gamble).

11. **P. rhamnoides**, Dcne.; Fl. Br. Ind. ii. 377; Gamble Darj. List 37. Vern. *Kumbúl, kangedoe*, Bhutia.

A small tree or shrub, often epiphytic. *Wood* hard, yellowish-brown. *Pores* very small, numerous, evenly distributed. *Medullary rays* fine, very numerous. *Annual rings* marked by a dark line.

Sikkim Himalaya, at 7–10,000 ft.

E 3403. Tonglo, Darjeeling, 9000 ft. (Gamble).

16. PHOTINIA, Lindl.

Five species. *P. Griffithii*, Dcne.; Fl. Br. Ind. ii. 381, is a large tree found by Griffith at Trelagong, in the Bhutan Himalaya, and *P. mollis*, Hook. f.; Fl. Br. Ind. ii. 381; Gamble Darj. List 37, a tree of the Darjeeling Terai, common in swamp forests, like the Dulka Jhar Reserve.

Wood brown, hard to moderately hard, close-grained. *Pores* small. *Medullary rays* fine, numerous.

1. **P. Lindleyana**, W. and A.; Fl. Br. Ind. ii. 380; Bedd. Fl. Sylv. xcviii.

A small tree. *Bark* dark brown, thin. *Wood* light brown, hard, close-grained. *Pores* small, uniformly distributed. *Medullary rays* fine, numerous, the distance between them about equal to the transverse diameter of the pores.

Shola Forests of the Nilgiri Hills at about 6000 ft.

		lbs.
W 3736.	Coonoor, Nilgiris, 6000 ft. (Gamble)	60

2. **P. Notoniana**, W. and A.; Fl. Br. Ind. ii. 380; Bedd. Fl. Sylv. t. 192; Trimen Fl. Ceyl. ii. 142. *Eriobotrya integrifolia*, Kurz For. Fl. i. 442. Vern. *Koda bikke*, Badaga.

A tree. *Bark* reddish-brown, peeling off in small flakes, thin. *Wood* light red, hard, close-grained, in structure resembling that of *P. Lindleyana*.

Khasia Hills at 4–5000 ft.; dry forests of the Nattoung Hills in Martaban, 7000 ft.; Nilgiri and Pulney Hill shola forests at 6–8000 ft.; highest elevations in Ceylon.

		lbs.
W 3865.	Aramby, Ootacamund, 7500 ft. (Gamble)	57
W 4082.	Lovedale " 6500 ft. "	—

3. P. integrifolia, Lindl.; Fl. Br. Ind. ii. 381; Gamble Darj. List 37. Vern. *Shumbul*, Lepcha.

A small tree. *Bark* thin, greyish-brown. *Wood* brown, moderately hard, close-grained. *Pores* small, uniformly distributed. *Medullary rays* fine, very numerous, the distance between them about equal to the transverse diameter of the pores. *Annual rings* marked by a sharp line.

Central and Eastern Himalaya from Nepal to Bhutan at 4–7000 ft.; Khasia Hills at 3–4000 ft.

A common tree about Darjeeling and Dumsong.

E 3400. Darjeeling, 7000 ft. (Gamble).

17. POURTHIÆA, Dcne.; *P. arguta*, Dcne.; Fl. Br. Ind. ii. 382, is a small tree of the lower Sikkim Himalaya, Khasia Hills and the hills of Upper Burma.

18. STRANVÆSIA, Lindl.

1. S. glaucescens, Lindl.; Fl. Br. Ind. ii. 382; Brandis For. Fl. 210. Vern. *Garmehal*, *súnd*, *gadmeuli*, Kumaon; *Godáru*, Garhwal.

A small evergreen tree. *Bark* ⅓ in. thick, rough, dark coloured. *Wood* light coloured when fresh cut, turning reddish-brown on exposure, fine- and even-grained; *annual rings* marked by a thin line. *Pores* very small, numerous. *Medullary rays* numerous, uniform, very fine, equidistant.

Central Himalaya, Kumaon and Garhwal, at 3–8000 ft., Nepal, Khasia Hills.

It is generally found in somewhat dry forests, associated with *Quercus incana*, *Rhododendron*, *Pieris* and *Symplocos*. Growth moderate, 7 rings per inch of radius.

	lbs.
H 2970. Naini Tál, 6000 ft. (Greig)	48

19. CRATÆGUS, Linn.

Four species. *C. Clarkei*, Hook. f.; Fl. Br. Ind. ii. 383, is a small tree of the hills of Kashmir, 8000 ft. *C. Wattiana*, Hemsl. and Lace in Journ. Linn. Soc. xxviii. 323, t. 40, is a small tree of Baluchistan.

1. C. Oxyacantha, Linn.; Fl. Br. Ind. ii. 383; Brandis For. Fl. 207; Gamble Darj. List 37. The Hawthorn. *Aubépine*, Fr.; *Weissdorn*, Germ.; *Biancospino*, Ital. Vern. *Ring*, *ringo*, *ramnia*, *pingyat*, *phindák*, *patakhan*, Pb.; *Ban-sanjli*, *súrsinjli*, Jhelum.

A small tree. *Bark* grey, shining, peeling off in long flakes and leaving a brown under-surface. *Wood* moderately hard, close- and even-grained. *Pores* small, very numerous, fairly evenly distributed, but more numerous and larger in the spring wood. *Medullary rays* very fine, very numerous. *Annual rings* marked by a line. Occasional medullary spots.

West Himalaya, from the Indus to the Ravi, at 5–9000 ft.; westwards to Europe; often cultivated.

Brandis says that the Himalayan fruit is better than that of the European Hawthorn. The wood is good for walking-sticks (McDonell). Mathieu Fl. For. 163 gives the weight at 46 to 56 lbs. per cubic foot. Aitchison says that it is common in the Kuram Valley, with a large fruit.

	lbs.
H 4831. Kalatop, Chumba, Punjab, 7000 ft. (Lace)	47

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1. C. crenulata, Roxb. Fl. Ind. ii. 509; Fl. Br. Ind. ii. 384. *C. Pyracantha*, Persoon; Brandis For. Fl. 208. Vern. *Gingáru*, *gangáru*, *gianru*, Hind.

A large spinescent shrub. *Wood* pale reddish-brown, hard, very

close- and even-grained. *Annual rings* marked by a belt of harder and darker-coloured wood on the outer edge of each ring. *Pores* very small, numerous. *Medullary rays* very fine, numerous.

Himalaya, from the Sutlej to Bhutan, at 5–7000 ft., descending in Kumaon to 2500 ft.

A pretty shrub which usually affects the banks of streams in the hills. The form cultivated in Europe and known as "Pyracantha" has a more straggling habit and bright red berries. The wood is used for walking-sticks in the hills.

		lbs.
H 2967.	Naini Tál	48
H 4667.	Jaunsar, 6000 ft. (Gamble)	50

20. COTONEASTER, Linn.

Eleven species, of which eight are erect trees or bushes and three are prostrate shrubs. *C. frigida*, Wall.; Fl. Br. Ind. ii. 385, is a small tree of the Central and Eastern Himalaya at 7–9000 ft.; where too is found *C. rotundifolia*, Wall., which is only a low shrub. *C. buxifolia*, Wall.; Fl. Br. Ind. ii. 387; Bedd. Fl. Sylv. xcvii.; Brandis For. Fl. 210; Vern. *Húrúnay*, Badaga (?), is a small rigid woody bush (Fl. Br. Ind.), a very rigid dense shrub or small tree (Bedd.) of the higher ranges of the Nilgiri and Pulney Hills, regarding which Beddome says, "the wood is very dense and elastic and the 'Todas make the clubs with which they kill their buffaloes from it."

Wood compact, hard, harder than that of *Pyrus*. *Pores* extremely small, uniformly distributed. *Medullary rays* very fine, very numerous.

1. **C. bacillaris**, Wall.; Fl. Br. Ind. ii. 384; Brandis For. Fl. 208. Vern. *Liun, ling*, Kashmir; *Rí, riu, lin, lún, ráu, reúsh rish, benang*, Pb. Hills; *Ruinsh, raunch, leonsh*, Jaunsar; *Tiching, changma*, Byáns.

A small deciduous tree. *Bark* thin, bluish-grey, nearly smooth. *Wood* white, turning light red towards the centre, smooth, very hard, close- and even-grained, but splits and warps much. *Annual rings* marked by the darker colour of the outer portion of each ring. *Pores* extremely small, uniformly distributed. *Medullary rays* very fine, very numerous.

Salt Range above 1500 ft.; West Himalaya, from the Indus to the Sarda, at 5–10,000 ft.; Sikkim and Bhutan (?).

A small tree, chiefly found in blanks in the forest, old grazing camps, etc., in the higher hill forests. Growth moderate, 11 rings per inch of radius. Weight, on an average, 57 lbs. per cubic foot. The wood is used for making walking-sticks: the "alpenstocks" used throughout the West Himalaya are usually made of it. Aitchison says that in the Kuram Valley it forms a great part of the scrub within the hills at 7–8000 ft., and is largely in request for agricultural implements, staves and bows.

		lbs.
H 55.	Nagkanda, Simla, 8000 ft.	61
H 2890.	" " " (Gamble)	—
H 26.	Madhan, Simla, 6000 ft.	58
H 124.	Kulu, about 7000 ft.	52
H 925.	Hazara " " (Baden-Powell)	56
H 3177.	Dungagalli, Hazara, 7000 ft. (Wild)	—
H 4774.	Balcha, Tehri-Garhwal, 9000 ft. (Gamble)	56
	Nordlinger's Sections, vol. 8.	

2. **C. acuminata**, Lindl.; Fl. Br. Ind. ii. 385; Brandis For. Fl. 209. Vern. *Riú, ráuns, riús, ruinsh*, Hind.; *Runinsh*, Garhwal; *Ruens*, Dotiál; *Ruinsh, leonshi*, Jaunsar.

A deciduous shrub. *Wood* hard, light reddish-brown, structure like that of *C. bacillaris*.

Himalaya, from the Beas to Sikkim, between 4500 and 10,000 ft.

A shrub or small tree of the underwood in the forests of Kharshu oak especially. Growth slow, 15 rings per inch of radius. Weight 53 lbs. per cubic foot. The wood is used to make walking-sticks, like that of *C. bacillaris*.

	lbs.
H 120. Jalaori Pass, Kulu, 9000 ft.	54
H 2889, 3013. Nagkanda, Simla, 8000 ft. (Gamble)	—
H 4773. Balcha, Tehri-Garhwal, 9000 ft. „	52

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3. **C. rosea**, Edgw. *C. bacillaris*, var. *affinis*; Fl. Br. Ind. ii. 385.

A large shrub. *Bark* grey, thin, peeling off in large flakes. *Wood* precisely similar to that of Nos. 1 and 2, resembling the latter especially in colour.

West Himalaya, from Kashmir to Kumaon, at 8–10,000 ft.
The identification of this pretty pink-flowered shrub is still rather doubtful.

	lbs.
H 4782. Deota, Tehri-Garhwal, 9000 ft. (Gamble)	48

4. **C. nummularia**, Fisch. and Mey.; Fl. Br. Ind. ii. 386.

A shrub. *Bark* grey, smooth. *Wood* white, moderately hard, in structure the same as the other species, Nos. 1, 2, 3, except that there is a line of *pores* marking the annual rings.

West Himalaya in Kashmir, 6–11,000 ft.; Afghanistan and Baluchistan.
In the Kuram Valley it makes up largely the scrub vegetation of the stony arid country (Aitchison).

P 4477. Baluchistan (Lace).

5. **C. microphylla**, Wall.; Fl. Br. Ind. ii. 387; Brandis For. Fl. 209; Gamble Darj. List 37. Vern. *Kháriz, lúni*, Kashmir; *Garri, ghadúli*, Kumaon; *Bheddu*, Jaunsar.

A small procumbent shrub. *Wood* hard, similar to that of the other species, but with slightly larger *pores* than in *C. bacillaris*.

Himalaya, from Kashmir to Bhutan, at 4–8000 ft. in the North-West and above 10,000 ft. in Sikkim. Often planted for ornament in England.
Growth slow, 24 rings per inch of radius.

	lbs.
H 2823. Simla, 7000 ft. (Gamble)	—
H 4794. Karamba, Jaunsar, 8000 ft. (Gamble)	48

21. OSTEOMELES, Lindl. *O. anthyllidifolia*, Lindl.; Coll. and Hemsl. in Journ. Linn. Soc. xxviii. 6, 56, is a shrub forming extensive thickets on the Shan Hills plateau in Upper Burma, at 4–5000 ft., and resembling the Blackthorn.

ORDER XLIV. SAXIFRAGACEÆ.

An Order of nine Indian arboreous genera, chiefly Himalayan. It is divided into three Tribes of woody plants, viz.—

Tribe I. Hydrangeæ	Hydrangea, Pileostegia, Dichroa, Deutzia, Philadelphus.
„ II. Escallonieæ	Itea, Pottingeria, Polyosma.
„ III. Ribesieæ	Ribes.

None of these have any particular importance in forest economy. Some of them are undergrowth shrubs in hill forests and useful as protecting forest-tree seedlings in their early stages.

Pores small to extremely small, in radial lines (*Itea*), or small transverse patches (*Ribes*) or regularly scattered. *Medullary rays* often of two sizes, sometimes broad and usually showing as a silver-grain.

1. HYDRANGEA, Linn.

Contains six Indian species. Besides those described, the chief is *H. altissima*, Wall.; Fl. Br. Ind. ii. 404; Brandis For. Fl. 211; Gamble Darj. List 38; Vern. *Kathmora*, Garhwal; *Sema*, Lepcha, a large climbing or erect shrub of the Himalaya from the Sutlej to Bhutan above 5000 ft. T. Thomson, who found it near Nagkanda, overlooking the Sutlej Valley, says the bark separates in long rolls like that of the birch, and is used as a substitute for paper ("W. Him. and Tibet," p. 47). *H. aspera*, Don, and *H. stylosa*, Hook. f. and Th., are small trees of the Sikkim Himalaya. *H. Pottingeri*, Prain in Journ. As. Soc. Beng. lxvii. ii. 2, 290, is a shrub of the Kachin Hills at 4000 ft. The Garden Hydrangea, or Chinese Guelder Rose, so commonly cultivated as an ornamental shrub in the hills, is *H. hortensia*, DC.

1. **H. vestita**, Wall.; Fl. Br. Ind. ii. 405; Brandis For. Fl. 211; Gamble Darj. List 38. Vern. *Kulain*, Bhutia; *Pokuttia*, Nep.

A small deciduous tree. *Bark* light brown, rather corky. *Wood* pinkish-white, moderately hard; *annual rings* indistinct. *Pores* extremely small. *Medullary rays* very fine.

Himalaya, from Kumaon to Sikkim, between 5000 and 11,000 ft.; sometimes epiphytic.

	lbs.
E 373. Tonglo, Darjeeling, 10,000 ft. (Johnston)	45

2. **H. robusta**, Hook. f. and Th.; Fl. Br. Ind. ii. 404; Gamble Darj. List 37. Vern. *Bogoti*, Nep.

A small, handsome, deciduous tree. *Bark* thin, brown, papery, peeling off in large flakes. *Wood* white, moderately hard, close-grained. *Pores* very small. *Medullary rays* of two sizes, moderately broad short, and very fine prominent.

Eastern Himalaya, Sikkim, at 5–7000 ft., generally as undergrowth in the oak forests, and very handsome when in flower.

Prain considers that the var. *Griffithii*, Clarke, which extends to the Kachin Hills, would be better considered as a distinct species.

	lbs.
E 2370. Rangbúl, Darjeeling, 7000 ft. (Gamble)	42

2. PILÆOSTEGIA, Hook. f. and Th. *P. viburnoides*, Hook. f. and Th.; Fl. Br. Ind. ii. 405, is a glabrous shrub of the Khasia Hills at 3–5000 ft.

3. DICHROA, Lour.

1. **D. febrifuga**, Lour.; Fl. Br. Ind. ii. 406; Gamble Darj. List 38. Vern. *Basak*, *bansúk*, Nep.; *Gebokanak*, Lepcha; *Singnamúk*, Bhutia.

An evergreen shrub. *Bark* yellow, peeling off in flakes. *Wood* white, moderately hard, with small *pores* and moderately broad to very fine *medullary rays*.

Common in the forests of the Eastern Himalaya, from Nepal to Bhutan and in the Khasia Hills, above 4000 ft.; highest levels in the Shan Hills and in the Kachin Hills of Burma.

The shoots and bark of the roots are made into a decoction and used as a febrifuge by the Nepalese. It is a handsome shrub, with blue flowers and bright blue berries, coming up on clearings in the oak forests, and often growing gregariously.

	lbs.
E 2371. Darjeeling, 7000 ft. (Gamble)	41

4. DEUTZIA, Thunb.

Contains three species. *D. macrantha*, Hook. f. and Th. is a shrub of the Kumaon Hills above 5500 ft. They are all ornamental shrubs.

1. **D. corymbosa,** Br.; Fl. Br. Ind. ii. 406; Brandis For. Fl. 212. Vern. *Bhatti*, Pangi; *Bhújlú, philrú*, Sutlej; *Daloutchi, deutsch, bhujru*, Simla; *Bhujroi*, Jaunsar.

A shrub. Outer *bark* yellowish-grey, peeling off in long thin papery rolls, leaving the smooth, thin, greenish-brown inner bark exposed. *Wood* white, soft, even-grained. *Pores* very small, very numerous. *Medullary rays* moderately broad, alternating with numerous very fine rays.

Himalaya, from the Sutlej to Bhutan, at 6–10,000 ft.; usually in forest undergrowth.

		lbs.
H 2850.	Mahasu, Simla, 7000 ft. (Gamble)	46
H 2898.	Nagkanda, Simla, 8000 ft. „	—
H 4784.	Raiengarh Forests, 7000 ft. „	47

2. **D. staminea,** Br.; Fl. Br. Ind. ii. 407; Brandis For. Fl. 212. Vern. *Deosú*, Sutlej; *Makamanni, manni*, Garhwal; *Bháti, muneti*, Kumaon; *Deutsch*, Simla; *Dahlochi*, Jaunsar.

A shrub. *Bark* grey, soft, peeling off in small strips, but to a less degree than in *D. corymbosa*. *Wood* white, soft; structure similar to that of *D. corymbosa*.

Himalaya, from Kashmir to Bhutan, at 5–8000 ft.; usually in blanks or on dry hill sides on the borders of the forest.

		lbs.
H 2836, 2819.	Simla, 6000 ft. (Gamble)	43
H 4785.	Thunwara Forest, Tehri-Garhwal, 7000 ft. (Gamble) . .	—

5. PHILADELPHUS, Linn.

1. **P. coronarius,** Linn.; Fl. Br. Ind. ii. 407; Brandis For. Fl. 212. The Syringa. Vern. *Khagás*, Pangi; *Daspá*, Sutlej; *Dalunchi, bhoj*, Simla.

A shrub. *Bark* soft, light grey. *Wood* soft, white, with large pith. *Pores* small and very small, more numerous near the inner edge of each annual ring. *Medullary rays* of two classes, very fine and moderately broad.

Himalaya, from Kishtwar to Sikkim, at 6–10,000 ft. Often planted for ornament.

		lbs.
H 3028.	Nagkanda, Simla, 7000 ft. (Gamble)	44
	Nordlinger's Sections, vol. 3.	

6. ITEA, Linn.

Four species. *I. macrophylla*, Wall.; Fl. Br. Ind. ii. 408; Gamble Darj. List 38; Vern. *Teturldumm*, Lepcha, is a small tree of the valleys around Darjeeling, found also in the Khasia Hills, and in the Kachin Hills of Burma. *I. chinensis*, Hook. and Arn.; Fl. Br. Ind. ii. 408, is a small tree of the Khasia Hills at 4–6000 ft. *I. riparia*, Coll. and Hemsl. is a shrub common on river-banks in the Southern Shan States in Upper Burma.

1. **I. nutans,** Royle; Fl. Br. Ind. ii. 408; Brandis For. Fl. 213. Vern. *Lelar*, Khagan; *Garkath*, Garhwal; *Chumli*, Kumaon.

A small tree. *Bark* very thin, brown, rough with small corky lenticels. *Wood* moderately hard, pink, close-grained. *Pores* small, in interrupted radial strings between the fine, numerous and close *medullary rays*. A pretty, fine, silver-grain.

West Himalaya and sub-Himalayan tract from Hazara to Kumaon, in damp swampy places under larger trees.

The wood is pretty and useful for small articles of turnery. Growth moderate, 8 to 9 rings per inch of radius.

		lbs.
O 4576.	Nakraunda Swamp, Dehra Dún (Gamble)	38

7. POTTINGERIA, Prain. *P. acuminata*, Prain in Journ. As. Soc. Beng. lxvii. 2, 291, is a shrub recently discovered by Capt. Pottinger in the Kachin Hills at 3700 ft.

8. POLYOSMA, Blume. *P. integrifolia*, Bl.; Fl. Br. Ind. ii. 409 (*P. Wallichii*, Benn.; Kurz For. Fl. i. 444), is a small tree of Assam and the Khasia Hills, also found in the Andaman Islands and having a light, pale-brown, close-grained, soft wood (Kurz).

8. RIBES, Linn.

Contains about eight species of Himalayan shrubs. *R. Grossularia*, Linn.; Fl. Br. Ind. ii. 410; Brandis For. Fl. 213; the Gooseberry; Vern. *Pilsa, pilikcha, kánsi, teila, amlanch*, Upper Chenab and Lahoul: *Sirkuchi, baikunti*, Byáns; *Yanghai*, Sutlej; *khanchi*, Pangi, is indigenous in the arid parts of the Western Himalaya above 8000 ft., and is cultivated in the hills. *R. nigrum*, Linn.; the Black Currant; Vern. *Papar*, Kumaon, is found in Kashmir, Kunawar, Garhwal and Kumaon above 6000 ft. *R. orientale*, Poiret; Brandis For. Fl. 214; Vern. *Gwaldokh, kaghak*, Kághan; *Nangke, nyái, phulanch*, Chenab; *nabri*, Pangi; *Askúta*, Ladak; *Yange*, Piti, is a shrub of the Safedkoh and arid tracts of the Inner Himalaya. *R. desmocarpum*, Hook. f. and Th., *R. luridum*, Hook. f. and Th., and *R. Griffithii*, Hook. f. and Th., are all shrubs of the Sikkim and Bhutan Himalaya.

1. **R. glaciale**, Wall.; Fl. Br. Ind. ii. 410; Brandis For. Fl. 214; Gamble Darj. List 38. Vern. *Robhay*, Bhutia.

A small shrub. *Bark* brown, peeling off in small flakes. *Wood* light reddish-brown, soft. *Pores* very small, arranged in small transverse patches which are straight or oblique between the broad *medullary rays*, which are not numerous, but make a well-marked silver-grain.

Himalaya, from Kashmir to Bhutan, at 8–11,000 ft. In the North-West it is found only at quite high elevations, in forest of "Kharshu" oak, and with *Rhododendron campanulatum*.

H 4575, 4641, 4788. Rikshin Range, Tehri-Garhwal, 10,000 ft. (Gamble).

2. **R. rubrum**, Linn.; Fl. Br. Ind. ii. 411; Brandis For. Fl. 215. The Red Currant. Vern. *Gwaldákh*, Khagan; *Róde, muradh, nábar, nábre*, Chenab.

A small shrub. *Bark* shining, peeling off in papery flakes. *Wood* white, compact, moderately hard. *Pores* extremely small, in narrow, short, interrupted, wavy, transverse lines, smaller and less clear than in *R. glaciale*. *Medullary rays* scanty, short, broad and very broad. Many medullary patches.

Himalaya, from Kashmir to Bhutan, at 7–11,000 ft.

		lbs.
H 3021, 3022.	Hattu, Simla, 10,000 ft. (Gamble)	63
H 2908.	Nagkanda, Simla, 9000 ft. „	—
H 3025.	Matiyána, Simla, 9000 ft. „	—
H 4787.	Balcha, Tehri-Garhwal, 9000 ft. „	47
E 973.	Chumbi Valley, Tibet, about 10,000 ft. (Schlich) . . .	58

ORDER XLV. HAMAMELIDEÆ.

Seven genera: Parrotia, Distylium, Sycopsis, Corylopsis, Loropetalum, Bucklandia, and Altingia, of which only the last two are important as timber trees. *Parrotia* has also considerable local importance in basket-work.

Wood close-grained. *Pores* small and very small, numerous and uniformly distributed. *Medullary rays* numerous, fine and very fine.

1. PARROTIA, C. A. Meyer.

1. P. Jacquemontiana, Dcne.; Fl. Br. Ind. ii. 426; Brandis For. Fl. 216, t. 28. Vern. *Páser, pasél, peshora, po, kilár, kirru,* Punjab; *Shtár,* Sutlej.

A large deciduous shrub or small tree. *Bark* thin, grey, shining. *Wood* light pinkish-white, hard, heavy, very close-grained. *Pores* extremely small, rather scanty. *Medullary rays* very fine, numerous, regular.

North-West Himalaya, from the Indus to the Ravi, between 2800 and 8500 ft.; Kuram Valley.

Growth slow, 12 to 16 rings per inch (Brandis). The wood weighs about 61 lbs. per cubic foot, and is highly esteemed for walking-sticks, tent-pegs, charpoys and rice-pestles, also for native bows for throwing pellets. But its chief use is in basket-work and in the making of bridges over the Himalayan rivers. The twigs are very tough and flexible, and are twisted together into thick ropes, often 300 ft. long. The bridges consist of one large rope to walk on and two smaller side ropes, one for each hand, with smaller ropes connecting the hand ropes with the foot rope. Aitchison says the twigs are made into wickerwork and used, plastered with clay, for the walls of houses in the Kuram Valley.

		lbs.
H 3178.	Dungagalli, Hazara, 6000 ft. (Wild)	—
H 933.	Hazara, Punjab, 6000 ft. (Baden-Powell)	56
H 905.	Upper Chenab, Punjab ,, ...	—
H 4747.	Chamba, Punjab (Elliott)	66

2. DISTYLIUM, Sieb. and Zucc. *D. indicum,* Benth.; Fl. Br. Ind. ii. 427, is a small tree of the Khasia Hills.

3. SYCOPSIS, Oliv. *S. Griffithiana,* Oliv.; Fl. Br. Ind. ii. 427, is another small tree of the Khasia Hills.

4. CORYLOPSIS, Sieb. and Zucc. *C. himalayana,* Griff.; Fl. Br. Ind. ii. 427, is a hazel-like shrub found in the hills of Bhutan at 5–8000 ft. and common in the Khasia Hills at 4–6000 ft.

5. LOROPETALUM, Br. *L. chinense,* Oliv.; Fl. Br. Ind. ii. 427, is a much-branched woody shrub of the Khasia Hills at 4–5000 ft.

6. BUCKLANDIA, R. Brown.

1. B. populnea, R. Br.; Fl. Br. Ind. ii. 429; Kurz For. Fl. i. 445; Gamble Darj. List 38. Vern. *Pipli,* Nep.; *Singliang,* Lepcha; *Dingdah,* Khasia.

A large evergreen tree. *Bark* rough, brown. *Wood* reddish-brown, rough, moderately hard, close-grained, durable. *Annual rings* marked by a dark line with fewer pores. *Pores* small, evenly distributed in radial lines. *Medullary rays* fine, very numerous, uniform and equidistant.

Eastern Himalaya, Khasia Hills and hills of Martaban, at 3–8000 ft.

A very handsome and useful tree, very ornamental, with bright shining poplar-like leaves and thick fleshy stipules; one of the most valuable trees of the Darjeeling Hills, and deserving of encouragement and careful propagation. It is easily grown from seed, and has been introduced into the Nilgiris, and also grown in greenhouses in England (see the fine specimens in the Temperate House at Kew). Good plantations have been successfully made in the Darjeeling Hills. Growth moderately fast, 6 to 7 rings per inch of radius. Weight, on an average, 45 lbs. per cubic foot. The wood is very much used in Darjeeling for planking and door and window frames, and is in great demand.

		lbs.
E 699.	Sepoydura Forests, Darjeeling, 5500 ft. (Johnston) .	41
E 2372, 2373.	Rangbúl Forest, Darjeeling, 7000 ft. (Gamble) .	46 and 49
E 3673.	Darjeeling, 6500 ft.	—

Nordlinger's Sections, vol. 9 (Tab. VII. 2).

7. ALTINGIA, Noronha.

1. **A. excelsa,** Noronha; Fl. Br. Ind. ii. 429; Kurz For. Fl. i. 446. Vern. *Jutili* Ass.; *Nantayôk*, Burm.

A lofty deciduous tree. *Bark* smooth, light grey, exfoliating in large thin flakes. *Wood* hard, red, cross-grained. *Pores* small, uniform and uniformly distributed in lines between the medullary rays. *Medullary rays* fine, equidistant, prominent on a radial section, as are also the pores.

Forests of Assam and Burma, locally abundant.

Growth moderate, 6 rings per inch of radius. S. E. Peal says of this tree (*Ind. Tea Gaz.*), "As a rule Jutili is a gregarious tree, remarkably tall and straight; the girth 'is from 6 to 10 ft. and the bole or shaft 50 to 60 ft., while the crown is often over 140 ft 'from the ground. If it is to be sawn, it should be cut when green or not quite dry. 'In the green state it is not at all difficult to cut and has a close grain; when dry it is 'extremely hard and difficult to cut either with edged tools or saws. It is extremely 'good for planks or indoor work in dry places, but too heavy for tea-boxes." He further says that felled and left in the forest it decays rapidly, being quite gone at the end of three years. In the hills of Java this is the principal timber tree, and grows to an enormous size, much larger even than the measurement given by Peal. It is called "*Rasamalah*," and the timber is the chief building material. There are splendid specimens in the forest near the Botanic Garden at Tjibodas on Mount Gedé, at about 4–6000 ft., often with huge buttresses to the trunks. Kurz gives its size as up to 180 ft. total height, 100 ft. first branch, 20 ft. girth, and says it gives a kind of gum *storax*.

	lbs.
E 1269. Lakhimpúr, Assam (Mann)	46
B 2704. Tavoy (Wallich, 1828)	46
Java specimen (Gamble)	54

Nordlinger's Sections, vol. 9 (*Liquidambar altingiana*, Bl.).

ORDER XLVI. RHIZOPHOREÆ.

Nine Indian genera of trees, chiefly coast plants and known by the general name of "Mangroves." They form forests, binding together the mud, in the estuaries of the Indus, Ganges and Irrawaddy, as well as along the coasts of Malabar, Coromandel, Orissa, Arracan, Tenasserim and the Andaman Islands. The Order is divided into two Tribes, viz.—

Tribe I. Rhizophoreæ	Rhizophora, Ceriops, Kandelia, Bruguiera.
„ II. Legnotideæ	Carallia, Gynotroches, Weihea, Blepharistemma, Anisophyllea.

As timber trees the Mangroves are not of very great importance, though some of them have fine woods, especially *Rhizophora*, and they are all of much value as fuel-producers. *Carallia* has a beautiful wood, and is an inland, not a coast tree, as is also *Weihea*.

Rhizophora, *Ceriops* and *Bruguiera* have small pores and equidistant, fine or moderately broad rays. The *pores* are sometimes joined by interrupted concentric bands. The structure of *Kandelia* is different. *Carallia* and *Anisophyllea* differ by having two classes of medullary rays: short very fine rays between the regular broad rays.

1. RHIZOPHORA, Linn.

Two species. *R. conjugata*, Linn.; Fl. Br. Ind. ii. 436; Bedd. Fl. Sylv. xcix.; Brandis For. Fl. 218; Kurz For. Fl. i. 447; Talbot Bomb. List 89 (*R. Candelaria*, DC; Trimen Fl. Ceyl. ii. 151), is a small tree usually associated with that here described.

1. **R. mucronata**, Lamk.; Fl. Br. Ind. ii. 435; Bedd. Fl. Sylv. xcix.; Brandis For. Fl. 217; Kurz For. Fl. i. 447; Talbot Bomb. List 88; Trimen Fl. Ceyl. ii. 151. *R. Mangle*, Roxb. Fl. Ind. ii. 459. Vern. *Bhara*, Beng.; *Kamo*, Sind; *Upoo-poma*, Tel.; *Kandal*, Tam., Mar.; *Sora pinnai*, S. Arcot; *Pyu*, Burm.; *Bairada, jumuda*, And.; *Kadol*, Cingh.

A small evergreen tree. *Bark* brown, fairly smooth, with vertical clefts. Sapwood light red; heartwood dark red, extremely hard, splits and warps a little in seasoning. *Pores* small to moderate-sized, often subdivided, fairly numerous; in alternate bands with few pores and many pores, so that a section of the wood shows alternately dark and light. These bands may represent annual rings. *Medullary rays* fine, wavy, numerous, uniform, equidistant; the distance between the rays equal to about twice the transverse diameter of the pores. On a radial section they give a pretty silver-grain.

Muddy shores and tidal creeks of India, Burma and the Andaman Islands.

Weight about 65 lbs. per cubic foot. The wood is good, but is rarely used. It is durable, *e.g.* B 2721 has been kept fifty years in Calcutta and is still quite sound. The bark is used for tanning, and the fruit is said to be edible. Of the quick germination of the Mangroves, Roxburgh says, "The great length of the seed gives in a very 'short time a young tree; for if the apex from which the root issues is only stuck a 'little way into a wet soil or mud, the leaves quickly unfold at the opposite end." The seeds often germinate while yet on the tree and drop as young plants into the mud. The roots also progress and form constantly fresh stems supported by the buttressed roots standing out of the mud.

		lbs.
B 2721.	Tavoy (Wallich, 1828)	69
B 502.	Andaman Islands (Genl. Barwell)	67
B 2240, 2273.	Andaman Islands (Col. Ford, 1866)	73
W 3906.	Cochin (Gamble)	64
D 4115.	South Arcot (Wooldridge)	56 (young)
No. 9, Ceylon Collection, old		65
No. 36 " "		49
Nordlinger's Sections, vol. 4.		

2. CERIOPS, Arn.

Two species.

1. **C. Candolleana**, Arnott; Fl. Br. Ind. ii. 436; Bedd. Fl. Sylv. xcix.; Brandis For. Fl. 218; Kurz For. Fl. 448; Trimen Fl. Ceyl. ii. 152. Vern. *Kirrari, chauri*, Sind; *Gorán, guttia*, Beng.; *Gatharu*, Tel.; *Pannikuthi, chirukandal*, Tam.; *Kabaing, kabyaing*, Burm.; *Madá*, And.

A small evergreen tree. *Bark* dark red. *Wood* orange-red, hard. *Pores* small, scanty, in short radial lines. *Medullary rays* moderately broad, slightly wavy, uniform and equidistant.

Muddy shores and tidal creeks of India, Ceylon and the Andaman Islands. In the Sundarbans it is the chief species in the forests west of the Arpangassia river, and in those towards the sea face of the Khulna District.

This is only a small tree or "simple-stemmed shrub," at most reaching 25 ft. in height with a girth of 18 in. (Schlich) and many buttresses at base. The wood is a very superior fuel, and gives excellent charcoal. It is used in Sind for the knees of boats and other purposes; in Lower Bengal for house-posts and for firewood. The bark is used for tanning, and recent experiments with tannin extracts at Dehra Dún showed that both the species of *Ceriops* gave very rich extracts indeed, likely to be most valuable. It is also used on the Coromandel coast for dyeing fishing-nets, as it preserves them from decay (Battie).

		lbs.
B 1985.	Andaman Islands (Kurz, 1866)	63
B 4742.	Burma	56
E 3700.	Sundarbans (Gamble, 1882)	—
D 4120.	South Arcot, Madras (Wooldridge)	—

2. C. **Roxburghiana,** Arnott; Fl. Br. Ind. ii. 436; Kurz For. Fl. i. 418; Trimen Fl. Ceyl. ii. 153. Vern. *Kabaing, kabyaing*, Burm.; *Gorán*, Beng.

A large shrub or small dwarf tree, evergreen, stem buttressed. *Bark* dark red, rough with blackish flakes which peel off. *Wood* orange-red, hard. *Pores* small, scanty, single or in short radial lines. *Medullary rays* moderately broad, numerous, regular, giving a marked silver-grain.

Coast tidal forests from the Sundarbans to Tenasserim; Eastern Coast of Ceylon, in the estuary of the Mahaweli river; Andaman Islands.

Like *C. Candolleana*, and with the same growth and same uses. Wallich (No. 173, *Rhizophora decandra*) gives W = 46 lbs.

		lbs.
E 4863.	Sundarbans (Fordyce)	56

3. KANDELIA, Wight and Arn.

1. **K. Rheedii,** W. and A.; Fl. Br. Ind. ii. 437; Bedd. Fl. Sylv. c.; Brandis For. Fl. 218; Kurz For. Fl. i. 449. Vern. *Goria*, Beng.; *Thuvarkandan*, Tel.

An evergreen shrub or small tree. *Bark* ¼ in., spongy, red-brown, peeling off in smooth flakes. *Wood* soft, close-grained, reddish-brown. *Pores* very small, very numerous. *Medullary rays* yellowish, very short, moderately broad, prominently marked on a radial section; the distance between the rays being many times broader than the transverse diameter of the pores.

Muddy shores and tidal creeks of Bengal, Burma and South India.

The wood is used only for firewood. The bark is used in Tavoy in dyeing red, probably as a mordant.

		lbs.
E 407.	Sundarbans (Richardson)	38
E 3698.	„ (Gamble, 1882)	35
D 4112.	South Arcot, Madras (Wooldridge)	—

4. BRUGUIERA, Lam.

Contains five species. *B. eriopetala*, W. and A.; Fl. Br. Ind. i. 438, is a tree of the swamps on the Malabar coast near Quilon. *B. malabarica*, Arn.; Fl. Br. Ind. i. 438, is also a Malabar coast tree. *B. parviflora*, W. and A.; Fl. Br. Ind. i. 438; Bedd. Fl. Sylv. ci.; Kurz For. Fl. i. 449; Talbot Bomb. List 89 (*Rhizophora parviflora*, Roxb. Fl. Ind. ii. 641); Vern. *Vurada*, Tel., is also found on the Malabar coast and about Masulipatam.

1. **B. gymnorhiza,** Lam.; Fl. Br. Ind. ii. 437; Brandis For. Fl. 219; Kurz For. Fl. i. 450. *B. Rheedii*, Bl.; Bedd. Fl. Sylv. c.; Talbot Bomb. List 89; Trimen Fl. Ceyl. ii. 153. *Rhizophora gymnorhiza*, Roxb. Fl. Ind. ii. 460. Vern. *Kakra, kankra*, Beng.; *Thuddu ponna, wurrurada*, Tel.; *Sigappu kakandan*, Tam.

An evergreen tree. *Wood* red, extremely hard. *Pores* small, oval, and subdivided. *Medullary rays* moderately broad, fine, very numerous.

Muddy shores and tidal creeks of India, Ceylon, Burma and the Andaman Islands.

The wood is used for firewood, house-posts, planks and articles of native furniture. Prain says this tree is the chief constituent of the Mangrove jungle in the Cocos Islands.

		lbs.
E 412.	Sundarbans (Richardson)	54

2. **B. caryophylloides,** Blume; Fl. Br. Ind. ii. 438; Bedd. Fl. Sylv. ci.; Kurz For. Fl. i. 450; Talbot Bomb. List 89; Trimen Fl. Ceyl. ii. 154. Vern. *Kakandan*, Tam.

A small tree. *Bark* dark brown, thin. *Wood* reddish, hard,

close-grained. *Pores* small, scanty, often subdivided. *Medullary rays* fine, numerous, wavy, with a pretty silver-grain.

Tidal forests of India and Burma; rare in Ceylon.

		lbs.
D 4110.	South Arcot, Madras (Wooldridge)	54

5. CARALLIA, Roxb.

Contain three species. *C. lanceæfolia*, Roxb. Fl. Ind. ii. 481; Fl. Br. Ind. ii. 439; Kurz For. Fl. i. 451, is an evergreen tree of the forests of Upper Tenasserim.

1. C. integerrima, DC; Fl. Br. Ind. i. 439; Bedd. Fl. Sylv. t. 193; Brandis For. Fl. 219; Gamble Darj. List 38; Talbot Bomb. List 90; Trimen Fl. Ceyl. ii. 155. *C. lucida*, Roxb. Fl. Ind. ii. 481; Kurz For. Fl. i. 451. Vern. *Kierpa*, Beng.; *Palamkat*, Nep.; *Kujitekra*, Ass.; *Júr*, Kól; *Shengali, panasi*, Mar.; *Varanga, vallayam*, Mal.; *Karalli*, Tel.; *Andipunar, andamargal*, Kan.; *Punschi*, Bombay; *Dawata*, Cingh.; *Bya*, Arracan; *Maniawga*, Burm.

An evergreen tree. *Bark* dark grey, thin. *Wood* hard, red. *Pores* moderate-sized or large, sometimes very large, often subdivided, often septate, often filled with resin. *Medullary rays* of two kinds: regular very broad ones prominent, with few fine short ones between, silver-grain prominent and handsome. Many irregular fine transverse bars joining or partly joining the broad medullary rays.

Forests of the sub-Himalayan tract, extending, but very scarce, to Dehra Dún in the west, common in the east; Assam, Eastern Bengal; Chota Nagpore, Orissa and the Circars, also about Cuddapah (Bedd.); evergreen forests of the Western Ghâts from the Konkan southwards; tropical and moist hill forests of Pegu and Martaban up to 4000 ft.; moist low country of Ceylon.

A handsome tree with thick shining leaves and aerial roots, which are seen even so far north as Dehra Dún, and show its connection with the Mangroves. The wood is very handsome, and useful for furniture and cabinet-making, especially when cut so as to show the beautiful silver-grain to advantage. Benson's experiments with bars 3′ × 1·4″ × 1·4″ gave W = 44 lbs., P = 797; Skinner, No. 37, found W = 44 lbs., P = 656; Bourdillon found W = 47 lbs., P = 700; A. Mendis found W = 42 lbs.; Brandis' Burma List, 1862, No. 106, 60 lbs.; the specimens give an average of 46 lbs. The structure of the wood is very interesting and beautiful.

The following are the results of the mechanical tests made by Prof. W. C. Unwin, F.R.S., for the Imperial Institute (*Imp. Inst. Journ.*, vol. v., May, 1899):—

Weight per cubic foot	47·33 lbs.
Resistance to shearing along the fibres . . .	1075 lbs. per sq. inch.
Crushing stress	2·670 tons per sq. inch.
Coefficient of transverse strength	4·83 ” ”
Coefficient of elasticity	561·3 ” ”

		lbs.
O 4489.	Ré nadi, Dehra Dún (Gamble)	48
C 3482.	Saranda, Chota Nagpore (Gamble)	—
W 4305.	South Kanara	—
W 743.	South Kanara (Cherry)	42
B 308.	Burma (1867)	47
B 816.	Burma (Ribbentrop)	51
B 2530.	Burma (Brandis, 1862)	47
B 2210.	Andaman Islands (Col. Ford, 1866)	47
B 1500.	Burma	—
No. 19,	Ceylon Collection, old and new (Mendis)	42
	Nordlinger's Sections, vol. 10 (Tab. VII. 3).	

2. C. calycina, Thw.; Fl. Br. Ind. ii. 439; Bedd. Fl. Sylv. ci.; Trimen Fl. Ceyl. ii. 155, t. 36. Vern. *Ubberiya*, Cingh.

A large tree. *Bark* thin, rough, grey. *Wood* red, in structure resembling that of *C. integerrima*, but the *pores* are fewer and the *broad rays* are narrower and at more regular distances.

Forests of the moist region of Ceylon, rare in the low country, more common in the hills, even to over 5000 ft., endemic.

A beautiful wood called *Dawata* by Ceylon carpenters. P = 464.

The following are the results of Prof. Unwin's mechanical tests:—

Weight per cubic foot	56·71 lbs.
Resistance to shearing along the fibres . . .	1066·6 lbs per sq. inch.
Crushing stress	3·433 tons per sq. inch.
Coefficient of transverse strength	4·505 „ „
Coefficient of elasticity	712·5 „ „

showing considerably greater weight and strength than does *C. integerrima*.

	lbs.
No. 90, Ceylon Collection, old; No. 138, new (Mendis).	51

6. GYNOTROCHES, Blume. *G. axillaris*, Miq.; Fl. Br. Ind. ii. 440; Kurz For. Fl. i. 451, is an evergreen small tree of Tenasserim.

7. WEIHEA, Spreng. *W. ceylanica*, Baill.; Fl. Br. Ind. ii. 441; Bedd. Fl. Sylv. t. 194; Trimen Fl. Ceyl. ii. 156; Vern. *Kanun*, Tam.; *Pana*, Cingh., is a tree of the forests of S. India in Tinnevelly and Travancore, and of the dry low country in Ceylon.

8. BLEPHARISTEMMA, Wall. *B. corymbosum*, Wall.; Fl. Br. Ind. ii. 441; Bedd. Fl. Sylv. ci., is a small tree of South India, said by Beddome to occur on the flats near Tellicherry and on the hills of Coorg at 2000 ft.

9. ANISOPHYLLEA, Br.

1. **A. zeylanica**, Bth.; Fl. Br. Ind. ii. 442; Trimen Fl. Ceyl. ii. 157; Bedd. Fl. Sylv. t. 195. Vern. *Wéli-penna, weli-piyanna*, Cingh.

A moderate-sized tree. *Bark* dark brown. *Wood* greyish-brown, moderately hard. *Pores* moderate-sized and large, filled with a white substance, prominent on a vertical section as white streaks. *Medullary rays* of two classes, numerous but indistinct, fine, between fewer moderately broad rays. Bars of soft texture and the same width as the rays crossing these and dividing the wood into numerous rectangular unequal figures.

Moist low country of Ceylon up to 3000 ft., endemic.

	lbs.
No. 96, Ceylon Collection, old; No. 154, new (Mendis)	35

ORDER XLVII. COMBRETACEÆ.

A very important Order to the Indian forester, containing as it does some of the most important and widely distributed of the trees of India, valuable not only for their timber and products, but for their influence on the sylviculture of the forests. Several species of *Terminalia* and *Anogeissus* are especially important, and it is possible that there is no tree in the Indian forests so widely distributed, so common and so important for the supply of the requirements of the agricultural population as is *Terminalia tomentosa*. Four of the genera contain only climbing shrubs, the rest trees, mostly of large size.

There are eight genera, divided among two Tribes, viz.—

Tribe I. Combreteæ	Terminalia, Calycopteris, Anogeissus, Lumnitzera, Combretum, Quisqualis.
„ II. Gyrocarpeæ	Illigera, Gyrocarpus.

Except that of the climbers and of *Gyrocarpus*, the *wood* is hard to very hard, with a distinct dark-coloured heartwood in most species. *Pores* of varying size, mostly grouped and in patches of loose tissue. *Medullary rays* fine or very fine, uniform, equidistant.

TRIBE I. COMBRETEÆ.

1. TERMINALIA, Linn.

Sixteen species, mostly important trees of large size, valuable for their timber, or as producers of tanning material, and of considerable importance in the sylvicultural management of Indian forests. The genus is divided into four subgenera according to the characters of the fruit.

The woods of the *Pentaptera* and *Chuncoa* sections are dark-coloured, rather like, but darker and rougher than, walnut; those of the *Catappa* section are lighter in colour, but have occasionally an irregular dark heartwood. In the former class the pores are larger and the texture rather more open, but in this respect *T. belerica* comes between the two. In all, the pores are in patches or single, and these patches are more or less concentrically confluent. In all, the medullary rays are fine, numerous and uniform. The wood of *T. Oliveri* resembles that of *T. Chebula* in the *Catappa* section, but has smaller pores.

SUBGENUS 1. CATAPPA.

Nine species. The fruits in this section are ovoid without wings. *T. fœtidissima*, Griff.; Fl. Br. Ind. ii. 445, is a tree of Mergui. *T. Manii*, King in Journ. As. Soc. Beng. lxvi. ii. 329, is a tree of the Andaman and Nicobar Islands. *T. argyrophylla*, King and Prain in Journ. As. Soc. Beng. lxvii. ii. 291, is a large tree of the Kachin Hills, believed to belong to this section.

T. parviflora, Thw.; Trimen Fl. Ceyl. ii. 160; Bedd. Fl. Sylv. ciii.; Vern. *Hanpalandra*, Cingh., is an endemic Ceylon tree with orange-brown wood. No. 48, Ceylon Collection, new (Mendis), may be the wood of this species, but the specimen is doubtful.

1. T. Catappa, Linn.; Fl. Br. Ind. ii. 444; Roxb. Fl. Ind. ii. 430; Bedd. Fl. Sylv. t. 20; Kurz For. Fl. i. 454; Talbot Bomb. List 91. *T. procera*, Roxb. Fl. Ind. ii. 249; Fl. Br. Ind. ii. 444; Kurz For. Fl. i. 454 (*fide* King). The Indian Almond. Vern. *Badam*, Beng.; *Taree*, Kan.; *Nat vadom*, Tam.; *Vedam*, Tel.; *Adamarram*, Mal.; *Kottamba*, Cingh.; *Catappa*, Malay.

A large deciduous tree, with whorled branches. *Wood* red, with lighter-coloured sapwood, hard. *Pores* moderate-sized, scanty, joined by wavy, short, concentric bands of soft texture. *Medullary rays* fine.

Beach forests of the Andaman Islands, including the Cocos, Car Nicobar and Batti Malv; cultivated in most parts of India and Burma, especially near the coast.

This handsome tree is best known from its being grown in avenues and gardens in many places, especially in Calcutta, where, in the cold season, the leaves turn red before falling. Weight, according to Skinner, No. 125, 32 lbs. per cubic foot. P = 470. Wallich also gives 32. Beddome says the wood is used for various purposes in Madras. The kernels of the nuts are eaten at dessert; they are remarkable for the spiral folds of the cotyledons; the bark and leaves give a black dye. It is one of the trees on the leaves of which the "Tasar" or Katkura" silkworm (*Antheræa Paphia*) is fed.

	lbs.
E 3005, 3712. Royal Bot. Garden, Calcutta (King)	—
B 1983. Andaman Islands (Kurz, 1866)	41
No. 78, Ceylon Collection, new (Mendis).	38

2. T. belerica, Roxb. Fl. Ind. ii. 431; Fl. Br. Ind. ii. 445; Bedd. Fl. Sylv. t. 19; Brandis For. Fl. 222; Kurz For. Fl. i. 455; Gamble Darj. List 39; Talbot Bomb. List 91; Trimen Fl. Ceyl. ii. 159. Vern. *Babela, beleyleh*, Pers.; *Bahera, bhaira, behara*, Hind.; *Bainda, bairo*, Kumaon; *Bohera*, Beng.; *Baheri*, Rajbanshi; *Kanom*, Lepcha; *Chiroræ*, Garo; *Hulluch, bauri, bhumra, bohora*, Ass.; *Thara*, Uriya; *Lupúng, lihúng*, Kól; *Lapong*, Sonthal; *Behra*, Mal Pahari; *Bahré*, Khond; *Tani, kattu elupay*, Tam.; *Tani, tandi, toandi, thandra*, Tel.; *Ahera, jhera*, Hyderabad; *Santi, thari*,

Kan.; *Bherda, bahera, hela, yela,* Mar.; *Beheda,* Kurku: *Bulra, balda,* Dekkan; *Behedo,* Mandevi; *Tahaka, taka, banjir,* Gondi; *Yehera,* Bhíl; *Adamaruthi,* Trav. Hills; *Búlú,* Cingh.; *Sacheng,* Magh; *Thitsein,* Burm.

A large deciduous tree. *Bark* ½ in. thick, bluish-grey, with numerous fine vertical cracks. *Wood* yellowish-grey, hard, no heartwood, not durable; readily attacked by insects; *annual rings* indistinct. *Pores* very scanty, large, frequently subdivided, joined by irregular, wavy, concentric bands of soft loose cellular tissue. Fine, uniform and equidistant *medullary rays* are distinctly visible in the harder and darker portions between the bands, and on the radial section, where too the pores prominent.

Throughout the forests of India, Burma and Ceylon, below elevations of about 3000 ft., and not in the dry and arid country of Sind and Rajputana.

The Bahera tree is a conspicuous one in the forests, and handsome when well grown. It is not gregarious, but is found in the deciduous forests associated with Teak, Sál, and such trees as *Terminalia tomentosa* and *Lagerströmia parviflora.* The timber is not in good repute, but is better than it is often supposed to be, and though in some parts it is so objected to that the tree is left quite uncut, and is consequently conspicuously big among the host of saplings of the new growth, in others it is rather liked, and is cut into building material willingly. Another cause of its being occasionally left uncut is its being in some parts of India, *e.g.* in the South Deccan, objected to as unlucky, or inhabited by demons.

Growth moderate to rapid, 3 to 7 rings per inch of radius. Weight, according to Kyd's Assam experiments, 43 lbs. per cubic foot; Central Provinces List, 39 lbs.; Bourdillon, 42 lbs.; Brandis' Burma List, 1862, No. 47, 40 lbs.; the average of specimens examined 48 lbs. Kyd gives P = 378, and Bourdillon 720. The wood is used for planking, packing-cases, canoes, and in the North-Western Provinces for house-building after steeping in water, which has the effect of making it more durable. In the Central Provinces it is used for plough shafts and carts when *bijasál* is not available. In South India it is used for packing-cases, coffee-boxes, catamarans, and grain measures. The fruit is one of the myrabolans, and is occasionally exported to Europe to be used in dyeing cloth and leather and in tanning, but is not so good as the Hirda fruit, and is barely worth the cost of collection and carriage. It is used also in native medicine. Native ink is made of it, and it is used in medicine as a purgative and for other purposes. The kernels of the fruit are eaten, but are said to produce intoxication if eaten in excess (Hunter's "Statistical Account of Bengal," xvi. p. 51), and an oil is obtained from them which is used for the hair. The fruit is eaten by monkeys, deer, goats, sheep, and cattle (Brandis). The tree gives a copious gum, which does not seem to be of much use, as it is not soluble in water. The seeds give a small quantity of oil, which is used medicinally. The wood is often bored and damaged by a Bostrichid beetle, *Synoxilon* sp., especially in the Thana forests of Bombay.

			lbs.
P	1190.	Madhopúr, Punjab (F. Halsey)	35
O	534.	Dehra Dún (O'Callaghan)	58
O	2995.	Garhwal (1874)	59
O	349.	Gorakhpur (1868)	52
C	176.	Mandla, Central Provinces (1870)	—
C	1125.	Ahiri Reserve, Central Provinces (R. Thompson)	42
C	2737.	Moharli Reserve, Central Provinces (Brandis)	44
C	2773.	Melghát, Berar „ „	—
D	4010.	Cuddapah, Madras (Higgens)	45
E	3600.	Darjeeling Terai (Gamble)	—
E	663.	Bamunpokri, Darjeeling Terai (Manson)	46
W	1188.	South Kanara (Cherry)	44
B	2532.	Burma (Brandis, 1862)	—
No. 53,		Salem Collection (marked *Wrightia antidysenterica*)	52

Nordlinger's Sections, vol. 8 (Tab. VII. 5).

3. T. Chebula, Retzius; Fl. Br. Ind. ii. 446; Roxb. Fl. Ind. ii. 433; Bedd. Fl. Sylv. t. 27; Brandis For. Fl. 223, t. 29; Kurz For. Fl. i. 456; Gamble Darj. List 39; Talbot Bomb. List 91; Trimen Fl. Ceyl. ii. 159. *T. tomentella,* Kurz For. Fl. i. 455.

Vern. *Harra, har, harrara,* Hind.; *Haira,* Kumaon; *Haritaki,* Beng.; *Hilikha,* Ass.; *Silim,* Lepcha; *Karedha, horada,* Uriya; *Halra, harla, hirda,* Mar.; *Rola,* Kól; *Hadra,* Oraon; *Hilda,* Berar; *Karka, hir, harro, mahoka,* Gondi; *Kadakai,* Tam.; *Kadukka,* Mal.; *Karaka, kadukar,* Tel.; *Heerda, anale,* Kan.; *Alalé,* Mysore; *Kajo,* Magh; *Panga,* Burm.; *Aralu,* Cingh.

A large or small deciduous tree. *Bark* ¼ in. thick, dark brown, with numerous generally shallow vertical cracks. *Wood* very hard, brownish-grey with a greenish or yellowish tinge, with an irregular small dark purple heartwood, close-grained, fairly durable. *Annual rings* indistinct. *Pores* small and moderate-sized, often subdivided, singly or in groups surrounded by small patches of soft texture which are slightly confluent into irregular more or less concentrically arranged bands. *Medullary rays* very fine; uniform, equidistant, numerous, stopping at or bent round the pores or groups of pores.

Throughout India and Burma, in deciduous forests chiefly, but also occasionally in rather moist mixed forests. In high level rocky and dry places on the outer Himalaya, the hills of the Deccan and South India it is only quite a small tree, but in valleys and forests of big trees it also grows big and gives a hard dark-coloured timber. In the outer Himalaya it may rise to even 5000 ft., and to almost as high as the Nilgiris and other South Indian ranges. In Ceylon it affects dry districts in the low country.

This is a very variable tree, the leaves having all stages of pubescence from being quite densely hairy to quite glabrous, and the fruit varying as greatly in size and extent of angularity. It is not proposed here to enter into the question of these varieties, some of which might perhaps be better treated as species.

Growth moderate, 6 to 10 rings per inch of radius. The weight and transverse strength have been determined by the following experiments:—

Name of person conducting experiment.	Year.	Wood whence procured.	No. of experiments.	Size of bar.	Weight.	Value of P.	
				ft. in. in.	lbs.		
Benson	—	Burma	—	3 × 1·4 × 1·4	58	1033	
R. Thompson	1868	Satpuras	—	—	63	—	
Brandis	1864	India	3	3 × 1 × 1	66	1090	
„ No. 48	1862	Burma	—	—	53	—	
Skinner, No. 129	1862	„	—	Various	60	1032	
„ No. 126	1872	South India	—	—	54	825	
Wallich	—	India	—	—	42	—	
Kyd	1831	Goalpara	1	2 × 1 × 1	56	850	*T. Hilkha*
O'Connell	1886	Coimbatore	—	—	61	—	a = 0·01203
Specimens examined	1878–99	Various	12	—	64	—	

The wood takes a good polish and is fairly durable; it is used for furniture, carts, agricultural implements and house-building. Beddome says it is cross-grained and difficult to work. The bark is used for tanning and dyeing. The fruit gives the black myrabolans, which are of a better quality than those of *T. belerica,* and are the most important Indian representatives of the *pyrogallol* tans, the chief of which is the Sumach. They are largely exported from Bombay to Europe. So valuable is this trade in the Southern Circle of Bombay that the Forest Department of that Circle clear annually at least Rs.50,000 clear profit from it alone. The Indian exports of myrabolans amount yearly to about 40,000 tons, valued at over 30 lakhs of rupees. Good Hirda fruits should be oval and pointed, of light colour, greenish-yellow in section and solid in structure. The unripe fruit is used for tanning, dyeing, and in medicine (*Balhar sengi, zangihar, kalchar,* Hind.; *Koki,* Nep.). The fruits give with alum a yellow dye, and with iron-clay give a good sort of ink. Astringent galls form on the young twigs, which are also used for ink and in dyeing and tanning. The kernel gives a transparent oil. Considerable damage is said to be done to the leaves of the tree by the bagworm moth, *Acanthopsyche Moorei,* Heyl., in the Madras Presidency.

			lbs.
O	213.	Garhwal (1868)	56
O	528.	Dehra Dún (O'Callaghan)	66
O	336.	Gorakhpur (1868)	60
C	181.	Mandla, Central Provinces	57
C	1159.	Ahiri Reserve, Central Provinces (R. Thompson)	66
C	842.	Bairagarh Reserve, Berar (Drysdale)	68
C	1247.	Gumsúr, Madras (Dampier)	60
C	3531.	Khuidha Forests, Orissa (Gamble)	59
D	4006.	Cuddapah, Madras (Higgens)	72
D	4027.	Collegal, Coimbatore (Peet)	72
D	1074.	North Arcot, Madras	—
W	4192.	Cochin (Kohlhoff)	72
No. 50, Salem Collection			62

Nordlinger's Sections, vol. 8 (Tab. VII. 6).

4. **T. citrina,** Roxb. Fl. Ind. ii. 435; Fl. Br. Ind. 446; Kurz For. Fl. i. 456. Vern. *Harra*, Hind.; *Haritaki*, Beng.; *Hilikka*, *silikka*, Ass.; *Hortucki*, Cachar; *Kyu*, Burm.

A large deciduous tree. *Bark* light grey, exfoliating with few large flakes. *Wood* grey, with an irregular dark heartwood of small size, not always present. Structure similar to that of *T. Chebula*, but the pores smaller and the concentric rings much more marked and prominent.

Eastern Himalaya in the lower hills from Nepal to Assam; Eastern Bengal, Burma and the Andamans.

This tree greatly resembles *T. Chebula*, and is scarcely more separable from it than some of the admitted varieties. The fruit is used similarly to the Hirda. The wood is used for planking and general building purposes in Assam; Wallich gives W = 60 lbs., the specimens examined also 60 lbs., per cubic foot.

			lbs.
E	671.	Bamunpokri, Darjeeling Terai (Manson)	67
E	2374.	„ „ „ (Gamble)	63
E	2197.	Nowgong, Assam (Mann)	49
B	1982.	Andaman Islands (Kurz, 1866)	—

5. **T. angustifolia,** Roxb. Fl. Ind. ii. 437; Fl. Br. Ind. ii. 449; Bourdillon in Journ. Bomb. Nat. Hist. Soc. xii. 351, t. 4. Vern. *Pei kadakkay*, *sutu maruthu*, Travancore; *Morgatchee*, Tam.

A very large tree. *Bark* pale brown, smooth, ¼ in. thick. *Wood* hard: sapwood yellowish-white; heartwood small, brown. *Pores* moderate-sized, surrounded by pale rings, sometimes subdivided, uniformly distributed, arranged in somewhat oblique strings. *Medullary rays* very fine, very numerous, stopping at or bending round the pores.

Evergreen forests of Travancore.

This tree is allied to *T. Chebula*, but differs greatly in appearance, and is found in the evergreen instead of in the deciduous forest. W = 51 lbs., P = 1012.

			lbs.
W	4726.	Travancore (Bourdillon)	51

Subgenus 2. PENTAPTERA.

Three species. Fruits with 5 acute wings.

6. **T. Oliveri,** Brandis in Hook. Ic. Pl. t. 2202 (1892). Vern. *Than*, Burm.

A moderate-sized tree with irregularly shaped, often channelled stem. *Bark* light grey, smooth, ¼ in. thick, exfoliating in rounded scales, leaving scars and pits as in *T. Arjuna*, inner bark orange

colour. *Wood* hard, close- and even-grained, resembling that of *T. Chebula:* sapwood yellow to grey; heartwood purplish-brown, streaked and clouded, very irregular. *Pores* small or very small, numerous, often subdivided, singly or in groups surrounded by patches of loose tissue which run into more or less concentrically arranged bands. *Medullary rays* fine and very fine, numerous, regular.

Burma, in the dry region of the Irrawaddy Valley, the lower part of the Chindwin and near the headwaters of the Sittang, up to about 23° 30′ N. lat.

This interesting tree has the wood of section *Catappa* with the fruit of section *Pentaptera.* It is usually associated with Cutch (*Acacia Catechu*), *Tectona Hamiltoniana, Pentacme siamensis* and *Terminalia tomentosa.* The extract of the bark, though itself poor in tannin, is used to adulterate Cutch. The tree may reach 50 ft. in height with a girth of 5 ft.

		lbs.
B 4845.	Mônywa, Lower Chindwin, Burma (H. Jackson)	56

7. **T. Arjuna,** Bedd. Fl. Sylv. t. 28; Fl. Br. Ind. ii. 447; Brandis For. Fl. 224. *T. crenulata,* Roth.; Kurz For. Fl. i. 458; Talbot Bomb. List 91. *T. glabra,* W. and A.; Trimen Fl. Ceyl. ii. 160. *Pentaptera Arjuna* and *glabra,* Roxb. Fl. Ind. ii. 438, 440. Vern. *Anjan, arjún, arjúna, anjani, arjan, jamla, koha, kowa, kahúa,* Hind.; *Arjún,* Oudh, Beng.; *Arjúno, panda sahajo,* Uriya; *Hanjal,* Cuttack; *Kowha,* Sonthal; *Gara patana,* Kól; *Mardi,* Khond; *Vella marda, vella matti, vella marúthú,* Tam.; *Arjun, anjan, sadura, savimadat,* Mar.; *Maddi, billi matti,* Mysore; *Yermaddi, érra maddi, tella madu,* Tel.; *Holematti,* Kan.; *Arjuna sadra,* Guz.; *Kahu,* Baigas; *Mangi, koha,* Gondi; *Taukkyan,* Burm.; *Kumbuk,* Cingh.

A large deciduous tree. *Bark* $\frac{1}{3}$ in. thick, smooth, pinkish-grey, the old layers peeling off in thin flakes. Sapwood reddish-white; heartwood brown, variegated with darker-coloured streaks, very hard. *Annual rings* doubtful. *Pores* moderate-sized and large, sometimes very large, uniformly distributed, more numerous and larger than in *T. tomentosa,* often subdivided into 2 to 4 compartments, each pore surrounded by a ring of soft tissue. Numerous thin, wavy, concentric lines, which frequently anastomoze. *Medullary rays* very fine, very numerous. Pores prominent on a longitudinal section.

Banks of rivers and streams throughout Central and South India, extending as far north as Oudh. Beyond that, towards the North-West and in the Punjab it is found only as a cultivated tree; Burma; low country of Ceylon.

This beautiful tree is recognized at once from *T. tomentosa* by its smooth grey bark, by its fruit angled rather than winged, by its narrower leaves, and by its preferring the banks of streams. Being confined to such localities, it is naturally not of much importance as a sylvicultural tree, but it is a fine tree for avenues in suitable localities, and is consequently almost more planted than its relative. It is easily propagated from seed, and the seeds germinate well in a natural state, reproducing in profusion.

Weight: Skinner's experiments, Nos. 123, 103, give 48 and 54 lbs.; the Central Provinces List 47 lbs.; while the average of the specimens examined is 59 lbs. Skinner gives P = 806 and 820. The wood is apt to split in seasoning and is not easy to work. It is used for carts, agricultural implements, boats and for building. It gives a brown transparent gum. The bark is used as a tonic and to heal wounds. The white wax insect, *Ceroplastes ceriferus,* Sign., is often found on its leaves in Chota Nagpore (V. Ball, M.A., "Jungle Life in India," p. 312).

		lbs.
C 179.	Mandla, C.P. (1870)	54
C 1111.	Ahiri Reserve, C.P. (R. Thompson)	60
C 2760.	Moharli Reserve, C.P. (Brandis)	—
C 3461.	Saranda Forests, Chota Nagpore (Gamble)	69
D 4019.	Collegal, Coimbatore	52

Nordlinger's Sections, vol. 9 (*T. macrocarpa,* Steud.).

8. **T. tomentosa,** W. and A.; Fl. Br. Ind. ii. 447; Bedd. Fl. Sylv. t. 17; Brandis For. Fl. 225; Kurz For. Fl. i. 458; Gamble Darj. List 39; Talbot Bomb. List 91.

Pentaptera crenulata, coriacea and *tomentosa*, Roxb. Fl. Ind. ii. 438–440. Vern. *Saj, sein, sain, asan, assain, assaina, asna, sadri*, Hind.; *Piasal, usan*, Beng.; *Jhau*, Rajbanshi; *Amari*, Ass.; *Taksor*, Lepcha; *Saháju, kala saháju*, Uriya; *Athna, sadra, sadara, sadora, ain*, Berar; *Barsaj*, Bijeragogarh; *Karra marda, karú marúthú, anemúi*, Tam.; *Maddi, nalla maddi, nella-madu*, Tel.; *Matti, kari matti, banapu*, Kan.; *Thembavu*, Mal.; *Sadri, hadri*, Guz.; *Murada, kali maruthai*, Arcot; *Karkaya, sadora, holda, dudi maddi*, Hyderabad; *Ain, madat, yên*, Mar.; *Saja*, Baigas; *Maru*, Gondi; *Madge*, Bhil; *Atana*, Sonthal; *Maddi*, Reddi; *Taukkyan*, Burm.; *Chouchong*, Taleing.

A large deciduous tree. *Bark* 1 in. thick, grey to black, with long, broad, deep, longitudinal fissures, and short, shallow, transverse cracks; inner substance red when fresh. Sapwood reddish-white; heartwood dark brown, hard, beautifully variegated with streaks of darker colour, showing on a radial section as dark streaks which are generally undulating. *Pores* moderate-sized and large, uniformly distributed, each pore enclosed in an irregularly shaped and generally elongated patch of soft tissue; these patches are often arranged in concentric lines and frequently joined by thin, wavy, concentric bands. *Medullary rays* not distinct, very fine, numerous, uniform, equidistant, often wavy, the transverse diameter of the pores many times larger than the distance between the rays.

Perhaps the most widely distributed of all the important Indian forest trees, and the one in the most universal employ for building native houses and other country purposes. It is found in the sub-Himalayan tract and Lower Himalaya from the Ravi eastwards, ascending to 4000 ft. in the hills, in places. From the Himalaya it extends down both Peninsulas; in dry rocky hillside forests it is often a stunted tree with grey pubescent large thick leaves, but in the moister places in valleys and on the plains it is a large tree with nearly glabrous, rather thin leaves. It prefers clayey soils, and in suitable places becomes gregarious. It has a deep taproot and stands considerable shade when young.

The weight and transverse strength of the wood have been determined by the following experiments:—

Experiment by whom conducted.	Year.	Wood whence procured.	No. of experiments.	Size of scantling.	Weight.	Value of P.
				ft. in. in.	lbs.	
Puckle	1859	Mysore	3	2 × 1 × 1	56	1010
(List)	1863	,,	—	—	57	—
(List) Paris Exhibition	1862	Central Provinces	—	—	50	—
R. Thompson	1869	,, ,,	—	—	55	—
Skinner, *No. 127	1862	South India	—	Various	60	860
,, †No. 128	1862	,, ,,	—	,,	55	840
Baker	1829	Jynaghur	4	7 × 2 × 2	62	677
French	1861	South India at Erode	—	15 × 1 × 1	59	882
Balfour	—	—	3	7 × 2 × 2	66	675
Benson	—	Burma	—	3 × 1·4 × 1·4	71	1001
Brandis, No. 50	1862	,,	—	—	58	—
,,	1864	,,	3	3 × 1 × 1	56	903
H. H. O'Connell	1886	Coimbatore	3	Various	65	$a = 0{\cdot}00930$
Talbot	1885	Bombay	1 4	7 × 2 × 2 6 × 2 × 2	57	779 615
Bourdillon	1892	Travancore	—	—	60	860
Specimens examined	1878–99	Various	17	—	67	—

* *T. coriacea*, Skinner, p. 148. † *T. glabra*, Skinner, p. 150.

Its durability is uncertain; in Burma the heartwood decays rapidly, in North India beams are sometimes found to last well, at other times to perish from dry rot or be eaten by insects. The wood is largely used for house-building, carts, rice-pounders, ship and boat building. It has been tried for railway sleepers. Five sleepers laid down on the Oudh and Rohilkhand Railway in 1870 were reported in 1875 to be in capital preservation, but having been cut from small trees the sapwood had been eaten, and the experiment could not be considered as good as if the sleepers had been from large trees and without sapwood. The wood splits, however, very much, unless thoroughly seasoned. The wood is an excellent fuel and makes good charcoal.

The bark is used for tanning and for dyeing black, and the ashes of the bark give a kind of lime which is eaten by the natives with betel leaf. Many experiments have been made in the extraction of tannin from the bark and wood in the form of extract; so far these experiments have been successful in showing that such an extract can be easily and abundantly made, but it is doubtful if it is sufficiently rich and good to be worth being made wholesale. Analysis of the ash of the wood (100 lbs. steam-dry wood gave 2·82 lbs. of ash) showed that of the 2·82 lbs., 2·11 were calcium carbonate. Its calorific power is 84·9 per cent. of that of pure carbon; and its evaporative power is 12·73 lbs. (1 lb. fuel evaporated 12·73 lbs. water at 212° Fahr.) (Leather). Mr. T. H. Holland says that the bark contains 17 per cent. of ash, nearly all carbonate of lime, evidently formed by the decomposition of oxalate of lime in the bark itself. Graham Anderson says that the Mysore natives burn the bark in order to get lime to chew with their betel.

It is one of the trees commonly attacked by the longicorn beetle, *Pachydissus holosericeus*, Fabr.; and the white wax insect is often found on it (*Ceroplastes ceriferus*, Sign.). The leaves are said not to be eaten by goats. The "tasar" silkworm (*Antheræa Paphia*) feeds on its leaves, and lac is occasionally gathered from its branches. It gives a brown gum. The cultivation of tásar in the Singbhúm District of Chota Nagpore is thus described by Mr. V. Ball, M.A. ("Jungle Life in India," p. 137): "The 'trees which it is intended to stock are carefully pollarded before the rains, and in 'early spring the leaves are stocked with young caterpillars which have been hatched 'in the houses. The men in charge erect wigwams and remain on the spot, and during 'the daytime have full occupation in guarding the large green caterpillars from the 'attacks of kites and other birds. The cocoons are collected after they are spun and boiled 'in a lye of woodash. This removes the glutinous matter and renders it possible to wind 'off the silk." Areas of low forest are usually selected where the tree is common, and all other trees are first carefully cut out. See also *B. Paranjpe* in Ind. For. xxviii. 192.

The tree is easily cultivated, reproduces very well and coppices freely. Natives prefer it in the form of poles for house-posts, but will also use mature wood. The growth is fairly fast.

			lbs.
O	207.	Garhwal (1868)	52
O	2996.	„ (1874)	65
O	874.	Kumaon Bhabar (Campbell)	53
O	390, 391, 393.	Oudh (Wood)	53, 54 and 56
C	332.	Gorakhpur (1868)	53
C	174.	Mandla, Central Provinces (1870)	61
C	2924.	Seoni, Central Provinces (Brandis)	70
C	1104.	Ahiri Reserve, Central Provinces (R. Thompson)	67
C	2743.	Moharli Reserve, Central Provinces (sapwood) (Brandis)	48
C	1241.	Gumsúr, Madras (Dampier)	64
C	3674.	Palamow, Chota Nagpore (Gamble)	—
C	3852.	Kurcholy Forests, Ganjam „	64
C	4104.	Godavari Forests „	—
E	662.	Bamunpokri, Darjeeling Terai (Manson)	49
E	2375.	Sukna, Darjeeling Terai (Gamble)	56
E	3590.	Darleeling Terai	—
W	755.	South Kanara (Cherry)	60
W	4189.	Cochin (Kohlhoff)	74
D	1059.	South Arcot (Beddome)	—
D	1077.	North Arcot „	64
D	1281.	Anamalai Hills „	69
B	2531.	Burma (Brandis, 1862)	59

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Terminalia alata, Roth., is synonymous with *T. tomentosa*, W. and A.; but the wood sent under this name from the Andamans (B 522, 46 lbs.) is evidently, judging from its structure, a different species. *Wood* brown, with dark purple streaks, very hard, smooth. *Annual rings* doubtful. *Pores* small, uniformly distributed. *Medullary rays* short, prominent, moderately broad and fine, joined by numerous, very fine, white, transverse lines, distinctly visible on a radial section as long shining plates. I do not know what it can be, unless it is *T. bialata* and No. B 1417 (see p. 345) is wrongly named. Or it may be *T. Manii.*

Subgenus 3. CHUNCOA.

Three species. Fruit with 3 unequal wings.

T. pyrifolia, Kurz For. Fl. i. 437; Fl. Br. Ind. ii. 448; Vern. *Lein*, Burm., is a large deciduous tree of mixed forests in Burma, the wood weighing 39 lbs. per cubic foot. It is common in Pyinmana and Western Meiktila Districts. Specimens B 4875, B 5020, B 5031, B 5054, have been sent as the wood of this species from various parts of Burma, but though they seem to be *Terminalia* woods of structure allied to that of *T. belerica*, they differ so much in bark and texture that I hesitate to accept any of them. Some of them may belong to *T. bialata*, also called "*Lein*."

9. T. paniculata, W. and A.; Fl. Br. Ind. ii. 448; Bedd. Fl. Sylv. t. 20; Brandis For. Fl. 226; Talbot Bomb. List 91. *Pentaptera paniculata*, Roxb. Fl. Ind. ii. 442. Vern. *Kindal, kinjal*, Mar.; *Neemeeri*, Tel.; *Pe-karakai, vem marúthú*, Tam.; *Honal, hongal, hunab, huluvá, hulvé*, Kan.; *Uloe*, Coorg; *Pu marutha*, Mal.; *Poo mardá, pillai mardá*, Anamalais.

A very large deciduous tree. *Bark* ¼ in. thick, dark brown, peeling off in flat flakes. *Wood* grey, with darker heartwood, very hard. *Pores* large and moderate-sized, oval, often subdivided, numerous, surrounded by faintly marked patches of soft tissue, arranged in oblique and wavy lines and connected into somewhat concentric bands. *Medullary rays* fine, uniform, wavy, numerous; the distance between them usually less than the diameter of the pores.

Hills of the South Deccan in Bellary and Cuddapah; deciduous forests of the Western Coast from the Konkan through N. Kanara to Travancore.

A fine tree with a good wood, but not so valuable as that of *T. tomentosa.* It is improved by being kept under water. It makes good planking, and is used for agricultural implements. Talbot, as the result of three experiments made in 1885, found W = 53 lbs., P = 628; Bourdillon found W = 57 lbs., P = 636; the specimens give W = 56. The tree grows well from seed, and the saplings grow fast. The bark gives a tan, and the branches are lopped for "*rab*" manure in the Konkan. Bourdillon says that the Travancore "country people have a tradition that tigers will never attack 'cattle kept in sheds made of this timber."

		lbs.
D 4277, 4308.	Seshachellam Hills, Cuddapah (Gamble)	58 and 48
D 1280.	Anamalai Hills, Coimbatore (Beddome)	65
W 1221.	North Kanara (Barrett)	57
W 4193.	Cochin (Kohlhoff)	54
W 4726.	Travancore (Bourdillon)	49

10. T. myriocarpa, Heurck and Muell. Arg.; Fl. Br. Ind. ii. 448; Kurz For. Fl. i. 455; Gamble Darj. List 39. Vern. *Panisaj*, Nep.; *Sungloch*, Lepcha; *Hollock*, Ass.

A very large evergreen tree. *Bark* greyish-brown, rough, peeling off in vertical flakes. *Wood* hard: sapwood light brown; heartwood dark brown, beautifully mottled with dark streaks. *Pores* large, rather scanty, singly or in small groups, surrounded by patches of light tissue, which sometimes, especially in autumn wood, run together into more or less concentric wavy bands. *Medullary rays* very fine, very numerous, uniform, stopping at or bending round the pore patches.

Eastern Himalaya from Nepal eastwards in valleys and lower hills up to 5000 ft., common and conspicuous; Assam; hills of Upper Burma.

A very handsome tree either in flower or fruit, that is either loaded on its pendent boughs with pink flowers or yellow fruit. It often grows of very large size, trees of over 20 ft. in girth having been recorded from the Sivoke Hills. Chevalier Paganini says of it, "Where *Uriam* (*Bischoffia javanica*) is found, there *hullock* is also found, . . . 'showing a gregarious tendency here and there. The timber is excellent for many purposes, 'straight-grained, pretty hard, does not warp or split to any considerable extent even 'when not seasoned, stands well in and out of doors. Its only enemy is a kind of small 'borer. It is peculiarly adapted for cheap furniture, windows, doors, railway carriages 'and generally for any work where accurate fitting is the main object" (*Timber Trades Journ.*, 1885). In the Darjeeling Hills it is much used for house-building and tea-boxes, sometimes for canoes, and makes excellent charcoal. Paganini gives the weight at 66 lbs., the specimens are lighter. It is distinctly a tree to be encouraged in the Darjeeling Hills, as it grows well in localities where the better timbers are scarce.

		lbs.
E 500.	Khookloong Forest, Darjeeling Terai (Manson) . . .	54
E 2376.	Bamunpohri " " (Gamble) . . .	51

E 2315 cut from a log of wood which had been lying for many years in the bed of the Chauwa Jhora, near Sivoke, in the lower Darjeeling Hills, and had become perfectly black, is probably this. W = 51 lbs. The wood is perfectly sound and good.

SUBGENUS 4. BIALATA.

One species. Fruit with 2 broad wings.

11. T. bialata, Wall.; Fl. Br. Ind. ii. 449; Kurz For. Fl. i. 456. *Pentaptera bialata*, Roxb. Fl. Ind. ii. 441. Vern. *Lein*, Burm.; *Chugalam*, And.

A large deciduous tree. *Wood* grey, beautifully mottled, moderately hard. Structure the same as that of *T. belerica.*

Burma and the Andaman Islands.

Weight: Brandis' Burma List, 1862, No. 49, gives 39; the specimen gives 48 lbs. per cubic foot. Skinner, No. 124, gives weight 64 lbs., and P = 1042, but there may have been some mistake. I am inclined to think the specimen is wrongly named and may be *T. belerica*. See also p. 344.

In the list of Andaman woods, Calcutta Exhibition, 1883-84, this tree is said to be abundant, having a wood of the colour of old oak, which works and polishes beautifully, weighs 50 to 53 lbs. per cubic foot, and squares up to 60 ft. long, siding 30 in.

Heinig says the pieces run up to 45 ft., and the wood makes good furniture and is used for oars, buggy shafts, and floor and ceiling planking.

		lbs.
B 1417.	Tharrawaddi, Burma	48

2. CALYCOPTERIS, Lamk.

1. C. floribunda, Lamk.; Fl. Br. Ind. ii. 449; Brandis For. Fl. 220; Talbot Bomb. List 291. *C. nutans*, Kurz For. Fl. i. 468. *Getonia floribunda* and *G. nutans*, Roxb. Fl. Ind. ii. 428. Vern. *Kokoranj*, C.P.; *Bandi murududu*, Tel.; *Kokundia*, Uriya; *Marsada boli*, Mysore; *Ukshi*, Mar.; *Wuksey, baguli*, Bombay; *Kyutnenwè, nabunwè*, Burm.

A large climbing shrub. *Bark* very thin, light brown, smooth. *Wood* soft to moderately hard, porous, light reddish brown. *Pores* of all sizes, usually large, scattered, alternating with long curved medullary patches of soft texture. *Medullary rays* fine, numerous, uniform.

Central and Southern India, especially in deciduous forest, or climbing over scattered trees or along watercourses in the Circars and Deccan; Eastern Bengal from Assam to Chittagong; mixed forests and river-banks and about villages in Burma. The structure of the wood is very curious.

		lbs.
C 2755.	Moharli Reserve, C.P. (Brandis)	45
C 3841.	Gumsúr forests, Ganjam (Gamble)	38
B 5026.	Tharrawaddy Division, Burma	36

3. ANOGEISSUS, Wall.

Five species. *A. phillyreæfolia*, Heurck and Muell. Arg.; Fl. Br. Ind. ii. 451 (*A. acuminata*, var. *phillyreæfolia*, Kurz For. Fl. i. 466), is a small tree of the Savannah and swamp forests in the plains of Burma, extending to the Shan Hills. (Brandis says "dry country of the Irrawaddy Valley"!)

Wood grey, usually with a small purple-brown heartwood, hard, close-grained. *Pores* small, in light-coloured patches sometimes arranged more or less concentrically (*A. latifolia* and *A. acuminata*), sometimes radially (*A. pendula*). *Medullary rays* fine, uniform, equidistant.

1. **A. latifolia,** Wall.; Fl. Br. Ind. ii. 450; Bedd. Fl. Sylv. t. 15; Brandis For. Fl. 227; Talbot Bomb. List 92; Trimen Fl. Ceyl. ii. 162. *Conocarpus latifolia*, Roxb. Fl. Ind. ii. 442. Vern. *Dhaura, dhauri, dhau, dhāwa, dhaula, dohu, bákla, bákli, bánkli*, Hind.; *Gólra, goldia, golia dhok, dhaukra, dhokri, dau*, Rajputana; *Khardháwa*, Banda; *Goria, golia dhau*, Merwara; *Dhaora, dhamora*, Berar; *Dhauta, seya*, Koderma; *Hesel*, Sonthal, Kól; *Vellay naga, namme, veckali*, Tam.; *Chiriman, shériman, yettama, tirman, yella maddi*, Tel.; *Dohu, dhobu*, Uriya; *Dhaori, dhamora, dhaunda, dandua, dhavada*, Mar.; *Mala kanjiram*, Mal.; *Dinduga, dindlu, bejalu, dindal*, Kan.; *Arma, yerma*, Gondi; *Dhawa*, Baigas; *Dhaundak*, Bhil; *Dhaura*, Kurku; *Muniah, miriah*, Khond; *Sirikara*, Palkonda; *Vellema*, Reddi; *Dawu*, Cingh.

A large deciduous tree. *Bark* smooth, whitish-grey, $\frac{1}{6}$ in. thick, with shallow, irregular depressions, caused by exfoliations. *Wood* grey, hard, shining, smooth, with a small purplish-brown, irregularly shaped, very hard heartwood; sapwood in young trees and branches yellow. *Annual rings* marked by lines without pores. *Pores* small, very numerous, often subdivided, surrounded either singly or in patches by loose tissue, the patches arranged obliquely or transversely in a roughly concentric fashion. *Medullary rays* very fine, extremely numerous, uniform, equidistant. The transverse diameter of the pores is about equal to the distance between the medullary rays.

Dry deciduous forests in the greater part of India: Lower Himalaya, sub-Himalayan tract and Siwaliks from the Ravi to Nepal, ascending to 3000 ft.; Behar, Chota Nagpore, the C.P., Rajputana; dry forests of the Bombay Presidency and down the Western Coast to Travancore, ascending to 3000 ft. on the Nilgiri and other hill ranges; Circars, Deccan and Carnatic; open grass lands in the dry country of Ceylon.

A conspicuous and well-known tree, important in the forest economy of the deciduous forests everywhere and easily recognized from its leaves turning red in the cold season, and its grey bark. On deep soils it grows to a large size, but in the dry rocky hills it keeps small and has the habit of a small tree with a rounded head. It reproduces well from seed as may be seen on fire-protected slopes on the Siwalik range, the outer Himalayan slopes and similar localities in Central and South India. The wood is in great demand for ordinary native country house-building and agricultural purposes. It resembles that of *Terminalic Chebula*, but the pores are smaller and the patches less distant.

Growth moderate, 7 rings per inch of radius. Weight 65 lbs. (Puckle and Skinner, No. 51); 61 (R. Thompson); 64 (Central Provinces List); 58 (Bourdillon); 61 and 67 (O'Connell); 75 to 80 lbs. when green; the specimens give an average of 62 lbs. Skinner gives P = 1220, while French of the Madras Railway gives 752, and Puckle, from 3 experiments with bars 2′ × 1″ × 1″, 870; Bourdillon gives 868, and O'Connell gives α = 0·00837 to 0·01015. The wood is highly valued on account of its great strength and toughness, but it splits in seasoning and unless kept dry is not very durable. It is used for axe-handles, poles for carrying loads, axles of carts, in the construction of furniture, for agricultural implements and in shipbuilding. It has been recommended for sleepers. Out of 18 sleepers which had lain 7 to 8 years on the Mysore State Railway there were found, when taken up, 4 good, 10 still serviceable and 4 bad; but

it splits too much, and is not always of a suitable size for economic conversion. It gives a good fuel and an excellent charcoal. It gives a gum which is extensively sold for use in cloth-printing. The leaves are used for tanning, which is carried out by making the skin into a bag and placing the leaves with water inside.

		lbs.
P 446.	Ajmere	—
O 233.	Garhwal (1868)	68
O 2997.	„ (1874)	64
O 531.	Dehra Dún (O'Callaghan)	62
O 394.	Oudh (Wood).	62
C 2776.	Melghát, Berar (Brandis)	59
C 190.	Mandla, Central Provinces (1870)	58
C 1121.	Ahiri Reserve, Central Provinces (R. Thompson)	65
C 2744.	Moharli Reserve, Central Provinces (Brandis)	55
C 1244.	Gumsúr, Madras (Dampier)	66
C 3684.	Palamow, Chota Nagpore (Gamble)	56
C 3562.	Khurdha Forests, Orissa „	62
C 3855.	Surada Forests, Ganjam „	66
C 4062, 4105.	Godavari Forests „	57
C 5083, 5084.	Saugor, C.P. (Somers Smith)	56
D 1282.	Anamalai Hills, Madras (Beddome)	56
No. 21,	Salem Collection	69

Nordlinger's Sections, vol. 10; also vol. 9 (*Conocarpus*) (Tab. VII. 4).

2. A. acuminata, Wall.; Fl. Br. Ind. ii. 450; Bedd. Fl. Sylv. t. 16; Brandis For. Fl. 228; Kurz For. Fl. i. 466. *Conocarpus acuminata,* Roxb. Fl. Ind. ii. 443. Vern. *Chakwa,* Beng.; *Panchi, pasi,* Uriya; *Numma,* Tam.; *Páchi mánu, panchman, paunchinan, bucha karum, pashi, pansi,* Tel.; *Ghor dhok,* Jeypore; *Gara hesel, pandri, pansi,* Kól; *Phás, phassi,* Mar.; *Saikamehhia, thekri napay,* Magh; *Yung, sehoong,* Arracan; *Yôn,* Burm.

A large deciduous tree. *Bark* ½ in. thick, dark grey, rough, granulated when old. *Wood* grey, sometimes yellowish-grey with a greenish tinge, shining, in structure moderately hard, resembling that of *Anogeissus latifolia,* but the *pores* considerably larger, and the zigzag concentric arrangement of the patches more marked.

River-banks, especially in the Northern Circars of Ganjam, Vizagapatam and Godavari, and the adjoining forests of Chanda, C.P., extending northwards through the Orissa Tributary States to Chota Nagpore; Chittagong and Burma in mixed forests, ascending to 3000 ft.; often cultivated, as in Calcutta and Madras.

A most beautiful tree with rough bark and drooping branches. The wood much resembles that of *Terminalia Chebula,* more so even than that of *A. latifolia,* as the pores are larger.

In forest economy the tree is not very important, as it is ordinarily found only on river-banks in company with *Terminalia Arjuna, Pongamia glabra* and *Eugenia Jambolana*; but for such localities it is valuable, and deserves encouragement. It appears to reproduce well from seed.

Skinner, No. 50, gives W = 59 lbs., P = 880; Brandis (Burma List, 1862, No. 51) gives W = 53 lbs., the specimens give W = 50 lbs. The wood is not so strong and good as that of *A. latifolia;* it warps and cracks in seasoning, and is not durable, especially when exposed to wet. The leaves are used for tanning in Gumsúr.

		lbs.
C 3462.	Saranda Forests, Chota Nagpore (Gamble)	—
C 3932.	Gumsúr Forests, Ganjam (Gamble)	44
C 1143.	Ahiri Reserve, C.P. (R. Thompson)	57
B 3204.	Burma (Brandis, 1862)	—
B 3095.	Prome, Burma	—

3. A. sericea, Brandis in Ind. For. xxv. 287. Vern. *Kardehi,* Hind.

A moderate-sized tree. *Bark* light brown or grey, smoothly waved, not fissured, ¼ in. thick. *Wood* yellowish-grey, hard, close-grained. *Pores* small, often subdivided, single or in more or less concentric

wavy groups, surrounded by loose tissue of a colour lighter than the rest of the wood. *Medullary rays* **fine, numerous, nearly equidistant.**

Guzerat, Rajputana and the Central Provinces, ascending to 4000 ft. in the hills of Pachmarhi.

		lbs.
C 4847.	Pachmarhi, C.P., 4000 ft. (Lala Behari Lal)	52
C 4865.	Jabalpur, C.P. (Fernandez)	50

4. **A. pendula**, Edgw.; Fl. Br. Ind. ii. 451; Brandis For. Fl. 229. Vern. *Dhau, dhaukra, kala dhaukra*, Meywar; *Kardahi*, Gwalior.

A small gregarious tree with pendulous branches, leaves turning copper-coloured in the cold season. *Wood* hard, yellowish-white, with a small, irregular, blackish-purple heartwood. *Annual rings* indistinct. *Pores* very small and extremely small, in somewhat radial groups between the very fine, very numerous, uniform and equidistant *medullary rays.*

Dry forests of Rajputana and Bandelkhand as far as the Nerbudda in Nimar and the Panch Mehals.

The principal forest tree in the Merwara and Meywar forests, having somewhat the aspect of a willow. The wood is strong, much resembling that of *A. latifolia*. Cunningham's 5 experiments made at Gwalior with bars 2′ × 1″ × 1″ give the weight at 59 lbs. per cubic foot and P = 837, the average of the 5 experiments which ranged from 697 to 1034. It coppices well, and the tree is, as Brandis remarks, deserving of attention.

P 454. Ajmere.

4. LUMNITZERA, Willd.

Two species. *L. coccinea*, W. and A.; Fl. Br. Ind. ii. 452 (*L. littorea*, Voigt; Kurz For. Fl. ii. 469) is a small evergreen tree of the mangrove swamps of Tenasserim and the Nicobar Islands.

1. **L. racemosa**, Willd.; Fl. Br. Ind. ii. 452; Bedd. Fl. Sylv. ciii.; Brandis For. Fl. 221; Kurz For. Fl. i. 468; Talbot Bomb. List 92; Trimen Fl. Ceyl. ii. 162. *Petaloma alternifolia*, Roxb. Fl. Ind. ii. 372. Vern. *Kripa, kirpa*, Beng.; *Kadivi, thandara*, Tel.; *Tipparathai*, Tam.; *Bériya*, Cingh.; *Yinyè, dawehmaing*, Burm.

An evergreen tree of shrubby growth. *Bark* ¼ in. thick, brown, hard, rough. *Wood* greyish-brown with a small darker heartwood, hard. *Pores* small, uniformly distributed, often subdivided or in short radial lines. *Medullary rays* fine, numerous, the distance between them about equal to the diameter of the pores.

Coast forests of India, Ceylon and Burma.

This tree is found in the Mangrove swamps, and is considered as a Mangrove, just as *Avicennia* and the *Sonneratias* are, though they do not actually belong to the Mangrove Order, *Rhizophoreæ*. The wood is strong and durable, and is used for house-posts and as fuel. The vertical sections often show a satiny water-marking. Weight about 54 lbs. per cubic foot.

		lbs.
D 3756.	Tummalapenta, Nellore (Gamble)	56
D 4117.	South Arcot (Wooldridge)	52
No. 10, Ceylon Collection, new (Mendis) doubtful	. . . . .	57

5. COMBRETUM, Linn.

About 18 species, mostly large climbing shrubs of the forests of Eastern Bengal and Burma, recognized at once by the 4- to 5-winged fruit. *C. acuminatum*, Roxb. Fl. Ind. ii. 228; Trimen Fl. Ceyl. ii. 163 (*C. costatum*, Roxb.; Kurz For. Fl. i. 465), is a large climber of Eastern Bengal. *C. Wallichii*, DC and *C. flagrocarpum*, Herb. Calc. are climbing shrubs of the hills of Darjeeling. *C. ovalifolium*, Roxb. Fl. Ind. ii. 256; Fl.

Br. Ind. ii. 458; Talbot Bomb. List 92; Trimen Fl. Ceyl. ii. 163; Vern. *Zelloosey*, *madbel*, Bombay, is a very large climber common in the forests of South India on both sides. The twigs are used to make ropes and rings to tie up cattle, and the gum is used.

C. nanum, Ham.; Fl. Br. Ind. ii. 457; Brandis For. Fl. 221; Vern. *Pharsia*, Kumaon, is one of those curious dwarf shrubby species common on grass lands, especially these liable to regular jungle-fires. It is found all along the Himalaya and in the Himalayan valleys, in Oudh, the C.P. and in the Shan Hills of Burma.

1. C. **decandrum**, Roxb.; Fl. Br. Ind. ii. 452; Roxb. Fl. Ind. ii. 232; Brandis For. Fl. 221; Kurz For. Fl. i. 460; Gamble Darj. List 39. Vern. *Pankh*, *pharsia*, *dhobela*, Hind.; *Rohal*, *ruel*, Dehra Dún; *Kalilara*, Nep.; *Pinrik*, Lepcha; *Pinlel*, Berar; *Palandu*, *koldungi*, Kól; *Kundol*, Bhumij; *Buria*, *raterr*, Kharwar; *Atundi*, *kora kukundi*, Uriya; *Tirumal*, Khond; *Madlat*, Monghyr; *Mandra tiga*, Reddi; *Arikota*, Tel.; *Thamakanwè*, Burm.

A large climbing shrub. *Bark* thin, brown, peeling off in flakes. *Wood* grey, soft. *Pores* large, very scanty, very irregularly distributed. *Medullary rays* extremely fine, numerous and regular.

From the Punjab along the Himalaya to Bhutan; Central Provinces and eastwards to Bengal, Orissa and the Circars.

Where it occurs, this is one of the most rampant and troublesome of the forest climbers. Almost impossible to kill, and seeming to thrive better the more it is cut, it sends out innumerable shoots of great length, and twines them over the tree vegetation, no matter how big. The white-bracted flowers and lilac-tinted young shoots are very beautiful; they have a rather sickly honeyed scent. Luckily, the plant is local, as in the Dehra Dún, where it is very common at the exit of the Jumna from the hills, but it is, unfortunately, spreading eastwards. In Midnapore, Orissa and the Circars it is very abundant and troublesome.

E 3301. Darjeeling Terai (Gamble).
Dehra Dún specimen (Gamble).

2. C. **apetalum**, Wall.; Fl. Br. Ind. ii. 453; Kurz For. Fl. i. 460. Vern. *Kyettetnwè*, *nabu*, Burm.

A large, straggling, semi-scandent shrub. *Bark* thin, greyish-brown. *Wood* grey, moderately hard. *Pores* moderate-sized, very scanty. *Medullary rays* very fine, numerous, regular.

Dry forests in Chittagong and Burma.

		lbs.
B 5014.	Prome Division, Burma	50

3. C. **extensum**, Roxb. Fl. Ind. ii. 229; Kurz For. Fl. i. 463; Talbot Bomb. List 92; Trimen Fl. Ceyl. ii. 164. Vern. *Piloka*, Bombay; *Maungmakawnwè*, *mananwè*, Burm.

A large woody climber. *Bark* light brown, fibrous, fluted. *Wood* brown, porous, moderately hard. *Pores* scanty, moderately large to very large, septate, prominent on vertical sections. *Medullary rays* fine, numerous, regular.

Deccan Peninsula and Ceylon; deciduous forests of Burma.

The specimens sent were named *Combretum apetalum*, but they do not at all agree with the Prome specimen of that species, and I believe them to be this. The wood of the very large climber, *C. ovalifolium*, is similar.

		lbs.
B 5033.	Rangoon Division, Burma	45
B 5096.	Shwègyin „ „	45

6. QUISQUALIS, Linn.

Three climbing shrubs. *Q. densiflora*, Wall.; Fl. Br. Ind. ii. 460, is a climbing shrub of Tenasserim. *Q. malabarica*, Bedd. is a large climber of the Carcoor Ghât on the scarp of the Wynaad plateau at 1500 ft.

1. **Q. indica**, Linn.; Fl. Br. Ind. ii. 459; Roxb. Fl. Ind. ii. 427; Brandis For. Fl 220; Kurz For. Fl. i. 467; Talbot Bomb. List 29. The Rangoon Creeper. Vern *Dawèhmaing*, Burm.

A climbing shrub. *Bark* thin, grey, peeling off in small flakes *Wood* soft, porous. *Pores* large, regularly distributed, often moderate-sized only in what are apparently springwood layers. *Medullary rays* fine, indistinct.

Burma, especially in the Shan Hills: commonly cultivated in Indian gardens everywhere in the plains country.

O 4918. Saharanpur Bot. Garden (Gollan).

Tribe II. GYROCARPEÆ.

7. ILLIGERA, Blume. Three species, all climbing shrubs. *I. khasiana*, C. B. Clarke, and *I. Kurzii*, C. B. Clarke, occur in the Khasia Hills of Assam, the latter extending down to Burma; while *I. Coryzadenia*, Meissn.; Fl. Br. Ind. ii. 460 (*I. appendiculata*, Kurz For. Fl. i. 469), is found in the tropical forests throughout Burma and in the Andamans.

8. GYROCARPUS, Jacq.

1. **G. Jacquini**, Roxb. Fl. Ind. i. 445; Fl. Br. Ind. ii. 461; Bedd. Fl. Sylv. t. 196; Kurz For. Fl. i. 470; Talbot Bomb. List 92; Trimen Fl. Ceyl. ii. 166. Vern. *Zaitun*, Hind.; *Pitella*, Uriya; *Tanaku, kumar puliki*, Tel.; *Pinlèthitkauk*, Burm.

A deciduous tree. *Bark* thin, greyish-white with a shining silvery lustre, smooth. *Wood* grey, soft. *Pores* large and moderate-sized, scanty, often subdivided, uniformly distributed, well marked on a longitudinal section. *Medullary rays* very short, moderately broad, the distance between them greater than the transverse diameter of the pores. A well-marked silver-grain.

South India, throughout the Deccan country, extending to the Circars and Orissa; Tenasserim and the Andaman Islands.

A conspicuous tree with large leaves and winged Sál-like fruit. The wood is used in South India to make boxes and toys. It is preferred to all others for catamarans. The seeds are made into rosaries and necklaces. Weight about 22 lbs. per cubic foot. Prain says it is common and gregarious in the Cocos Islands. The chief toy-manufacturers are at Kondapalli in the Kistna District.

		lbs.
C 3517.	Sonakalla, Khurdha, Orissa (Gamble)	—
D 1079.	North Arcot, Madras (Beddome)	23
D 3889.	Soampalli, Cuddapah, 1500 ft. (Gamble)	18
D 3931.	Cuddapah Forests (Higgens)	26

Order XLVIII. MYRTACEÆ.

An important Order, containing many useful Indian trees, as well as a number of valuable introduced species. Most of the species have aromatic leaves containing essential oils, and some of them have pleasant fruits, largely cultivated. The 13 genera belong to three Tribes, viz.—

Tribe I. Leptospermeæ	Leptospermum, Melaleuca, Callistemon, Eucalyptus, Tristania.
„ II. Myrteæ	Psidium, Rhodamnia, Rhodomyrtus, Decaspermum, Eugenia.
„ III. Lecythideæ	Barringtonia, Careya, Planchonia.

But of these, two, *Callistemon* and *Eucalyptus*, contain introduced trees only, those of the former genus being frequently met with in gardens, and those of the latter being largely cultivated and in some cases run wild. Several other genera of Myrtaceous plants have also species to be seen in cultivation, especially on the hills of South India, such as the Australian *Angophora* and *Syncarpia*. The myrtle (*Myrtus communis*, Linn.), the

well-known aromatic South European shrub, is common in Indian gardens, especially in the more temperate regions. Aitchison says it is planted about graves in the Kuram Valley. *Pimenta officinalis*, Ldl., of the West Indies, is the Pimento or Allspice tree.

There is no very marked Family character in the wood of the species of this Order. The *pores* are usually small to moderate-sized, often arranged in more or less conspicuous concentric belts, or else radially in short strings. The *medullary rays* are fine and numerous, broad only in *Barringtonia*.

Tribe I. LEPTOSPERMEÆ.

1. LEPTOSPERMUM, Forst. *L. javanicum*, Blume; Fl. Br. Ind. ii. 464, is a shrub found on exposed rocks about Moulmein in Burma at 5000 ft. Some Australian species of the genus may be seen in cultivation on the Nilgiri Hills in South India.

2. MELALEUCA, Linn.

1. **M. Leucadendron**, Linn.; Fl. Br. Ind. ii. 465; Roxb. Fl. Ind. iii. 397; Kurz For. Fl. i. 472. *M. Cajuputi*, Roxb. Fl. Ind. iii. 394. Vern. *Kayaputi*, Hind.

An evergreen tree. *Bark* white, thick, spongy, peeling off in papery flakes. *Wood* reddish-brown, hard. *Pores* moderate-sized, scanty, producing wavy lines on a vertical section. *Medullary rays* very fine, extremely numerous.

Tenasserim and Mergui, rare; common in the Malay Peninsula, Malay and Molucca Islands.

The leaves give the Cajuput oil, used for rheumatism and for other medicinal purposes.

		lbs.
O 3270.	Botanic Garden, Saharanpur (Duthie)	—
O 4564.	" " " (Gollan)	49
E 3714, 3715.	Royal Bot. Garden, Calcutta (King)	46 and 50

3. CALLISTEMON, R. Br.

Australian small trees or shrubs, with flowers in dense cylindrical, usually pendulous, spikes and narrow leaves.

1. **C. salignus**, DC; Benth. and von Muell. Fl. Aust. iii. 120.

A small tree, with yellow stamens. *Bark* rough, thin, vertically fissured. *Wood* light reddish-brown, hard, close-grained. *Pores* small, evenly distributed in a slightly concentric arrangement. *Medullary rays* very fine, very numerous, the distance between them equal to the diameter of the pores.

Australia; occasionally cultivated in Indian gardens.

		lbs.
O 4636.	Forest School Garden, Dehra Dún (Gamble)	56

2. **C. lanceolatus**, DC; Benth. and von Muell. Fl. Aust. iii. 120.

A small tree, with red stamens. *Bark* greyish-brown, rough, ¼ in. thick, deeply cleft vertically into narrow ridges. *Wood* red, hard, very close-grained. *Pores* small to moderate-sized, roughly arranged in concentric fashion. *Medullary rays* very fine, very numerous, the distance between them equal to the diameter of the pores.

Australia; frequently cultivated in Indian gardens.

		lbs.
O 4661.	Forest School Garden, Dehra Dún (Gamble) . .	54

4. EUCALYPTUS, L'Hér.

A genus of Australian trees, of which 134 species were described by Bentham an von Mueller in the "Flora Australiensis." To that number, several more hav since been added. Among the trees, commonly known as Eucalypts, are the mo important timber trees of the Australian continent, and the timbers of some of then notably the "Jarrah" (*E. marginata*, Sm.) and "Karri" (*E. diversicolor*, von Muell. are largely exported from Australia for various purposes, and especially for sleeper and street paving-blocks. Among them, also, are some of the giants of the Vege table Kingdom, chief among which are the "Blue Gum" (*E. Globulus*, Lab.) an *E. amygdalina*, Labill. In the *Tropical Agriculturist*, vol. v. p. 752, specimens of th former 500 ft. high and of the latter 450 ft. high are referred to. In Kerner an Oliver's "Nat. Hist. of Plants," i. 722, trees of *E. amygdaline* are mentioned as reachin 152 metres in height (nearly 500 ft.) All the species are more or less aromatic, th leaves and flowers containing conspicuous oil-glands, the oils obtained from which ar of very great value in medicine. The flowers are usually showy, white or red, and th flower-buds have the calyx-tube covered with a deciduous operculum. The fruit i a hard capsule, with many small seeds. The leaves mostly hang with their blades i the vertical plane, and those of young trees are generally of a shape very different fron that which is assumed by those of the mature trees.

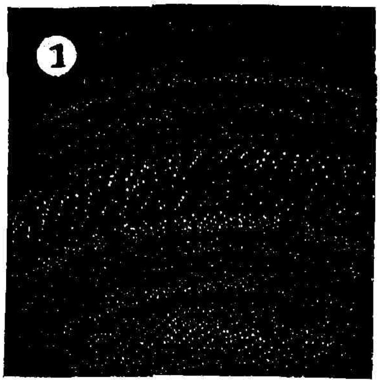
It is probable that the earliest attempts to grow the Eucalypts in India were those made on the Nilgiri Hills in 1843 by Captain Cotton, who planted *E. Globulus* at Ootacamund on the estates known as Gayton Park and Woodcot. He was followed, in 1856, by General Morgan, and the first Government plantation was made in 1862 (D. E. Hutchins, in his "Report on Measurements of Australian Trees on the Nilgiris, Madras, 1883"). There are now very large areas, partly belonging to the Government, partly to private persons, on the Nilgiris and the other hill ranges of South India and on the mountains of Ceylon, planted with Eucalypts and flourishing well, capable of easy reproduction, and supplying a cheap fuel and some building timber. In other parts of India, Eucalypts have not been so successful as on the Nilgiris, the chief localities where they have thriven being Abbottabad in the hills of the Punjab, and Ranikhet and Almora in Kumaon (on this see papers in "Ind. Forester," ii., by J. E. O'Conor and Sir D. Brandis). In some places in the plains of Northern India, such as Lahore, Changa-Manga, Dehra Dún, Saharanpur, Lucknow, fairly grown specimens may be seen; and the Canal Department have made plantations, especially near Hardwar.

The species are very difficult of identification, but the following are a few of the chief species which I have observed on the Nilgiris and identified with tolerable certainty: (1) *E. amygdalina*, Labill.; (2) *E. obliqua*, L'Hér.; (3) *E. siderophloia*, Benth.; (4) *E. crebra*, F. Muell.; (5) *E. pulverulenta*, Sims; (6) *E. Globulus*, Labill.; (7) *E. longifolia*, Link and Otto; (8) *E. robusta*, Sm.; (9) *E. viminalis*, Labill.; (10) *E. calophylla*, R. Br.; (11) *E. corymbosa*, Sm. In the plains of S. India, *E. tereticornis*, Sm., and *E. rostrata*, Schlecht, are occasionally seen in cultivation. In the North of India, according to Brandis (Ind. For. ii. 139) *E. amygdalina*, Labill., *E. viminalis*, Labill., *E. resinifera*, Sm., and *E. rostrata*, Schlecht, are the chief species found. At Dehra Dún, only two species really thrive, viz. *E. tereticornis*, Sm., and *E. citriodora*, Hook., the latter a tall straight-growing species with very light grey smooth bark and lemon-scented foliage.

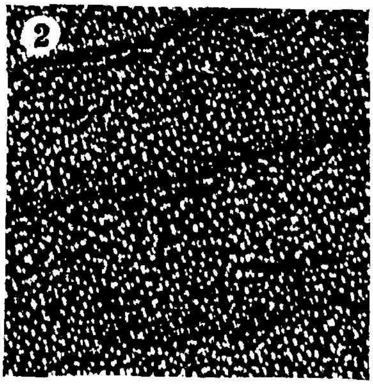
A great deal has been written, urging the more extended cultivation of Eucalypts in India; but until some species is found which, with a minimum of trouble, can be grown and will thrive on poor barren soils where indigenous trees are wanting, there seems no object in spending money on their further growth. On the Nilgiris, the growth of the "shola" trees was found to be so slow that there was danger of the indigenous growth being exhausted, and so the introduction of the quick-growing Eucalypts and wattles was an important measure; but where a large supply of cheap fuel is not required, and where indigenous trees of better timber can be got to grow easily, there seems to be no need for planting the Australian trees.

Eucalypts are easily grown from seed, but transplanting often fails, so that, as is regularly done on the Nilgiris, basket-planting is by far the best plan. Once well started, the Eucalypts, in the soil and under the climate which the species used prefers, grow well and fast; they coppice readily, and having very light canopy can be grown very close together. As ornamental trees, they are often valuable, but too many are likely, as experience at Ootacamund has well shown, to make the scenery somewhat

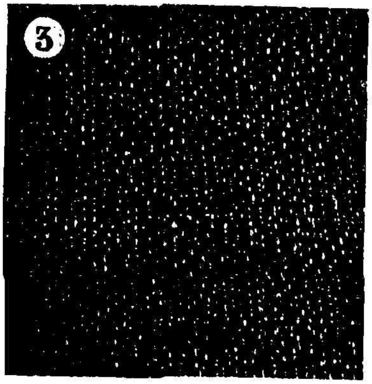
VIII.



EUCALYPTUS GLOBULUS.

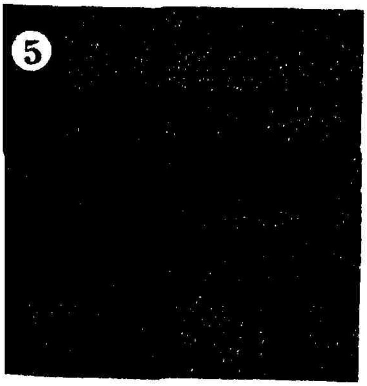


EUGENIA JAMBOLANA.



BARRINGTONIA ACUTANGULA.

LAGERSTRÖMIA FLOS-REGINÆ.



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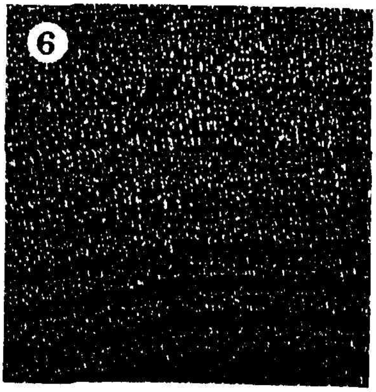

NYSSA SESSILIFLORA.

(*Magnified* 3½ *times.*)

uninteresting. Some species, however, are handsome, and from an ornamental point of view it may be well to try and replace the Blue Gums of Ootacamund by handsomer kinds, such as *E. robusta* and *E. calophylla*. On the whole, however, India has indigenous trees in all the regions where it is possible to grow such exotics as the Australian Myrtaceæ, which are quite as beautiful, have better timber and are more suitable for permanent cultivation in almost all respects except that of quickness of growth.

1. **E. Globulus,** Labill.; Benth. Fl. Aust. iii. 225; Brandis For. Fl. 231. The Blue Gum. Vern. *Kurpoora maram*, Madras.

A lofty tree with fibrous deciduous grey outer bark. In Australia the wood is brown, hard, tough, durable. The *wood* of the tree grown on the Nilgiris is grey, with darker streaks and moderately hard. *Pores* small to moderate-sized, round, in groups or in radial or oblique lines; closely packed in concentric belts in the annual rings. *Medullary rays* fine, very numerous, the intervals between the rays smaller than the diameter of the pores. Pores marked on a longitudinal section, and medullary rays visible as a silver-grain on a radial section.

Indigenous in Victoria and Tasmania; introduced into India, and now largely grown on the Nilgiris and other hills of S. India and on the Ceylon mountains, and apparently quite naturalized. Elsewhere it has only partially succeeded.

The chief Nilgiri plantations, which may now be called forests, as most of them are in their second term of rotation, are those of Norwood, Aramby, Bathri, Rallia and Coonoor Peak (there are many others, and many private forests), and these were described fully in Mr. D. E. Hutchins' work already referred to. Mr. Hutchins found that the average rate of growth in quantity of material was 12 tons per acre per annum. The present Working Plans are all, or nearly all, for coppice under standard, and the rotation for coppice has been settled at 10 years. The reproduction has been very good, perhaps not so good as it would have been in simple coppice, but still very good; and to any one not accustomed to the tree and its power of growth, the first view of such a forest as that of Bathri or Coonoor Peak seems little short of marvellous.

Planting is nearly all now done with basket transplants of about six months' age, and in this way less than 10 per cent. vacancies can be secured, while transplanting without baskets used rarely to give less than 30 per cent. failures. The tree does best in ravines, but will also grow well on the open grass-lands. It often comes up self-sown on fields near the forest. The leaves give the important "Eucalyptus oil," which is now manufactured to a considerable extent on the Nilgiris.

The wood of the Nilgiri tree splits badly, so that it can only be used for rough carpentry; in its native home it is clearly much better, and is used for house-beams, railway-sleepers and bridge-work. Its chief use in India is for firewood and charcoal. The weight is: for Australian wood 64 lbs.; for Nilgiri wood about 46 lbs. per cubic foot. Laslett gives P = 534.

	lbs.
W 1094. Nilgiri Hills, 7400 ft., age 18 years, height 95 ft. . . .	43
W 1095–8. " 6000 ft., age 2, 3, 4, 5 years, height 42 to 60 ft. .	—
W 4056. Bleak House, Nilgiris, 6000 ft. (Gamble)	50

Nordlinger's Sections, vol. 6 (Tab. VIII. 1).

Hough's "American Woods," vol. viii. No. 183.

2. **E. marginata,** Sm.; Benth. Fl. Aust. iii. 209. The Jarrah or Bastard Mahogany.

A large tree. *Bark* red, thick, ¾ in., very fibrous, deeply cleft, peeling off in thin flakes. *Wood* hard, sapwood white, heartwood red. *Pores* small, scanty, scattered unevenly, but chiefly in pale concentric bands. *Medullary rays* very fine, very numerous.

Indigenous in W. Australia; cultivated on the Nilgiris, but does not do well.

W 3815. Rallia Plantation, Nilgiris, 7500 ft. (Gamble).

3. **E. obliqua,** L'Hér.; Benth. Fl. Aust. iii. 204; Brandis For. Fl. 231. The Stringy Bark.

A large tree. *Bark* ¾ in. thick, very fibrous, soft, peeling off

in stringy flakes. *Wood* hard, sapwood grey, heartwood light red. *Pores* moderate-sized, scanty, enclosed in pale tissue and arranged in short radial or oblique strings. *Medullary rays* very fine, very numerous. Occasionally, numerous white wavy lines across the rays.

Indigenous in N. S. Wales, Victoria, Tasmania and S. Australia; cultivated in the Nilgiris, especially in Aramby, Rallia and Coonoor Peak Plantations.

	lbs.
W 3914. Aramby Plantation, Nilgiris, 7500 ft. (Gamble) . . .	48

4. **E. amygdalina,** Labill.; Benth. Fl. Aust. iii. 202. Peppermint tree.

A large tree. *Bark* ¼ in. thick, grey, often almost white, smooth, peeling off in papery flakes. *Wood* hard, light brown, liable to split. *Pores* small, moderately numerous, in long radial lines or oblique lines first one way, then the other. *Medullary rays* extremely fine, very numerous.

Indigenous in N. S. Wales, Victoria and Tasmania; cultivated in the Nilgiris and very common and conspicuous.

Locally this has been called "*E. piperita,*" but I believe the identification here given is really correct.

	lbs.
W 3915, 4048. Aramby Plantation, Nilgiris, 7500 ft. (Gamble) . .	48

5. **E. calophylla,** R. Br.; Benth. Fl. Aust. iii. 255.

A large tree. *Bark* orange-red, corky-fibrous, ½ in. thick, peeling off in narrow fibrous threads. *Wood* hard, sapwood grey, heartwood light brown. *Pores* moderate-sized, usually in radial lines of 3 to 6, joined by concentric white bars. *Medullary rays* fine, numerous.

Indigenous in West Australia; cultivated on the Nilgiris about Ootacamund and in Coonoor Peak Plantation. One of the finest species and very ornamental.

	lbs.
W 4092. Coonoor Peak Plantation, 6000 ft. (Gamble)	43

6. **E. tereticornis,** Sm.; Benth. Fl. Aust. iii. 241.

A large tree. *Bark* grey, exfoliating in long flakes. *Wood* hard, reddish-brown, close-grained. *Pores:* few moderate-sized, the rest small, in patches of pale tissue arranged in concentric bands. *Medullary rays* very fine, very numerous, indistinct. Has a damp or slightly oily feel, even when dry.

Indigenous in Queensland, N. S. Wales and Victoria; cultivated in various places in the Indian plains.

	lbs.
O 4525. Forest School Garden, Dehra Dún, 2000 ft. (Gamble) . .	56

5. TRISTANIA, R. Br.

Three species. *T. merguensis,* Griff.; Fl. Br. Ind. ii. 466; Kurz For. Fl. i. 473, is a tree of Tenasserim, found in Mergui; where also is found *T. Griffithii,* Kurz; Fl. Br. Ind. ii. 467; Kurz For. Fl. i. 474. *T. conferta,* R. Br. is an Australian tree cultivated in the Nilgiri Hills. It is known in Australia as "Brush Box."

1. **T. burmanica,** Griff.; Fl. Br. Ind. ii. 466; Kurz For. Fl. i. 474. Vern. *Taungyopyizin,* Burm.

An evergreen tree. *Bark* light brown, smooth but granular. *Wood* light brown. *Pores* small, scanty, often in radial pairs or threes. *Medullary rays* moderately broad, regular, numerous.

Eng forests on the slopes of the Pegu Yoma and drier hill forests of Martaban up to 3500 ft.; Tenasserim.

	lbs.
B 5061. Thongwa Division, Burma (a little doubtful)	42

TRIBE II. MYRTEÆ.

6. PSIDIUM, Linn.

1. **P. Guava,** Raddi; Fl. Br. Ind. ii. 468; Brandis For. Fl. 232; Kurz For. Fl. i. 476; Gamble Darj. List 40; Talbot Bomb. List 93. *P. pomiferum* and *P. pyriferum*, Willd.; Roxb. Fl. Ind. ii. 480. The Guava. Vern. *Amrút, amrúd, safri-ám*, Hind.; *Amuk*, Nep.; *Sungram*, Lepcha; *Modhuriam*, Ass.; *Piyara*, Beng.; *Gaya*, Magh; *Segapu, koaya*, Tam.; *Jama, coya*, Tel.; *Pela*, Mal.; *Sebe*, Kan.; *Malaka*, Burm.

A small evergreen tree. *Bark* smooth, thin, greenish-grey, peeling off in thin flakes. *Wood* greyish-brown, moderately hard, even-grained. *Pores* small, numerous, in short radial groups. *Medullary rays* fine, short, numerous, indistinct.

Introduced from America and now cultivated and occasionally found semi-wild all over India.

Weight: Wallich gives 44 lbs.; the specimens examined 42 lbs.; Skinner 47 lbs. and P = 618.

The Guava is only cultivated for its fruit, which is good, some of the best varieties very good. It is much eaten and largely used to make jelly and other preserves. The bark is used in medicine as an astringent, and (or the leaves) for dyeing in Assam. Skinner says that the wood works well and smoothly, that it is used for wood-engraving and for spear-handles and instruments.

		lbs.
O 1371.	Gonda, Oudh (Wood)	42
O 4526.	Dehra Dún (Gamble)	46
D 4273.	Horsleykonda, Cuddapah, 4000 ft. (Gamble)	38

Nordlinger's Sections, vol. 5 (*Psidium pyriferum*).

7. RHODAMNIA, Jack.

1. **R. trinervia,** Blume; Fl. Br. Ind. ii. 468; Kurz For. Fl. i. 475.

A large shrub or small tree. *Bark* grey, wrinkled. *Wood* brown, moderately hard, with faint irregular but more or less concentric very narrow lines of loose texture. *Pores* small to moderate-sized, irregularly distributed, occasionally in somewhat concentric lines. *Medullary rays* few, moderately broad to broad, with many very fine between them.

Tenasserim; Nicobar Islands. Extends through Malaya to Australia.

Nordlinger's Sections, vol. 4 (*Myrtus trinervia*, Sm.).
" " " 7 (*Myrtus melastomoides*, F. M.).

8. RHODOMYRTUS, DC.

1. **R. tomentosa,** Wight; Fl. Br. Ind. ii. 469; Bedd. Fl. Sylv. cvi.; Trimen Fl. Ceyl. ii. 166. The "Hill Gooseberry" of the Nilgiris; "Wild Guava" of Ceylon. Vern. *Thaontay, thavithoo*, Badaga; *Koratta*, Trav. Hills.

A large shrub with grey foliage. *Bark* very thin, red, papery. *Wood* dark red or reddish-brown, very hard, close-grained. *Pores* small, scanty, evenly distributed. *Medullary rays* of two kinds, fine and very fine, very numerous and close, making a fine silver-grain on a radial section.

Hills of South India, on the Nilgiris, Pulneys, etc., above 5000 ft.; Newera Ellia and surrounding hills in Ceylon.

Common on dry slopes, especially on the eastern side of the Nilgiri plateau, and at once recognized by its grey foliage, pink flowers and gooseberry-like but velvety fruit. The fruit tastes like the gooseberry, and is eaten raw or made into preserves. The wood makes excellent walking-sticks. Growth slow, 10 rings per inch of radius. W = 61 lbs.

		lbs.
W 3738.	Coonoor, Nilgiris, 6000 ft., (Gamble)	56
W 3885.	Aramby, Ootacamund, 7000 ft. "	57
W 4033.	Cairn Hill, Ootacamund, 7000 ft. (Gamble)	66
W 4287.	Doddabetta, Ootacamund, 8000 ft. "	65

9. DECASPERMUM, Forst. *D. paniculatum*, Kurz; Fl. Br. Ind. ii. 470; Kurz For. Fl. i. 475, is an evergreen tree of the hill forests of the Martaban Hills, freely coming up in deserted patches of temporary cultivation, at 3-4000 ft. According to King (*Jour. As. Soc. Beng.* lxx. ii. 76), it is also found in the Sikkim Terai and Khasia Hills.

10. EUGENIA, Linn.

One of the largest, perhaps the largest, of the Indian genera of trees. It contains about 110 species, chiefly found in the moist zones of North-East and South India and Burma; 33 occur in South India, and 30 to 40 in Burma, 4 in the North-West and Central India, and a large number in Eastern Bengal. Forty-three species are met with in Ceylon, of which 29 are endemic. Few of them are, however, of great importance; and it will be best to give a simple list of the few more important species to be mentioned in addition to those specially described, omitting those which are rare, or small, or otherwise unimportant.

No. in Fl. Br. Ind.

SUBGENUS 1. JAMBOSA.

2. E. **amplexicaulis**, Roxb. Fl. Ind. ii. 483, "a stately tree, native of Chittagong" (Roxb.).

6. E. **Munronii**, Wight; Bedd. Fl. Sylv. cix.; Vern. *Ilambili*, Tam., a tree of the Khasia Hills and W. Gháts.

7. E. **aquea**, Burm.; Roxb. Fl. Ind. ii. 492; Bedd. Fl. Sylv. cix.; Kurz For. Fl. i. 494; Trimen Fl. Ceyl. ii. 169; Vern. *Wal-jambu*, Cingh., a tree of river-banks in the Anamalai Hills, Ceylon, Chittagong and Burma.

10. E. **macrocarpa**, Roxb. Fl. Ind. ii. 497; Kurz For. Fl. i. 492; Vern. *Chalta jamb*, Beng., a tree of Assam, Chittagong and Burma, remarkable for its large fruit resembling that of the *Chalta* (*Dillenia indica*).

19. E. **hemispherica**, Wight; Bedd. Fl. Sylv. t. 203; Talbot Bomb. List 94; Trimen Fl. Ceyl. ii. 170, a large tree of the Western Ghát forests and Ceylon.

28. E. **ramosissima**, Wall.; Gamble Darj. List 40; Vern. *Jamu*, Nep., a tree of the Sikkim Himalaya, Khasia Hills and Sylhet.

SUBGENUS 2. SYZYGIUM.

34. E. **Thumra**, Roxb. Fl. Ind. ii. 495; Kurz For. Fl. i. 488; Vern. *Tawthabye*, *thatthabye*, Burm., an evergreen tree of marshy forests in Burma.

43. E. **claviflora**, Roxb. Fl. Ind. ii. 488; Kurz For. Fl. i. 480; Gamble Darj. List 40; Vern. *Jamu*, Nep.; *Muntet*, Lepcha; *Lumba-nuli jamb*, Beng., a tree of the Sikkim Himalaya, Assam, Eastern Bengal, Tenasserim and the Andamans.

45. E. **Wightiana**, Wight; Talbot Bomb. List 94 (*E. lanceolata*, Bedd. Fl. Sylv. cix.; Trimen Fl. Ceyl. ii. 172), a tree of the Western Gháts and Ceylon.

47. E. **zeylanica**, Wight; Kurz For. Fl. i. 481; Talbot Bomb. List 94 (*E. spicata*, Bedd. Fl. Sylv. t. 202; Trimen Fl. Ceyl. ii. 171); Vern. *Nyara*, Mal.; *Pitculi*, Mar.; *Marungi*, Tam.; *Maranda*, Cingh., a small tree of the Western Gháts and Ceylon.

60. E. **venusta**, Roxb. Fl. Ind. ii. 491; Kurz For. Fl. i. 487; Vern. *Thabyega*, Burm., an evergreen tree of the Tippera Hills, Chittagong and Martaban.

77. E. **oblata**, Roxb. Fl. Ind. ii. 403; Kurz For. Fl. i. 488; Vern. *Thabyeni*, Burm., a tree of Assam, Eastern Bengal and Burma, in wet places.

97. E. **malabarica**, Bedd. Fl. Sylv. t. 199, a common tree of the Wynaad forests at 2–4500 ft.

SUBGENUS 3. EUEUGENIA.

ruticosa, Roxb. Fl. Ind. ii. 487; Kurz For. Fl. i. 485; Vern. *Ban-jam,* ng.; *Thabyeni,* Burm., a tree of Eastern Bengal and the Eng forests of rma.

looniana, Wight; Bedd. Fl. Sylv. cx.; Talbot Bomb. List 95; Trimen Ceyl. ii. 187; Vern. *Pini-baru,* Cingh., a small tree of the Western âts, also of Ceylon, where the yellowish wood is used to make special lking-sticks.

hyllata, Thunb. is the Clove tree, a native of the Moluccas, occasionally India and now much cultivated at Zanzibar.

ough, moderately hard to very hard, seasons well, usually greyish-brown. *Pores* small to moderate-sized, more or ed in concentric bands, sometimes joined by pale tissue of cells. *Medullary rays* fine, numerous.

SUBGENUS 1. JAMBOSA.

nosa, Wall.; Fl. Br. Ind. ii. 471; Kurz For. Fl. i. 492; Gamble Darj. *ernifolia,* Roxb. Fl. Ind. 489. Vern. *Bara jaman,* Nep.; *Bunkonkri, bak, panchidung,* Gáro; *Famsikól,* Lepcha.

erate-sized evergreen tree. *Bark* greyish-white, smooth, *d* grey, hard. *Pores* moderate-sized. *Medullary rays* ry fine, numerous, prominent.

nalaya and sub-Himalayan forests from Nepal eastwards; Assam, Eastern urma.

he banks of streams, with large handsome flowers and large fruit.

	lbs.
Tista Valley, Darjeeling (Gamble)	61

laccensis, Linn.; Fl. Br. Ind. ii. 471; Roxb. Fl. Ind. ii. 483; Kurz . Vern. *Thabyuthabye,* Burm.

rate-sized evergreen tree. *Wood* reddish-grey, rough, soft. rate-sized and large. *Medullary rays* broad or moderately ing a silver-grain.

in Bengal and Burma for its fruit.

	lbs.
Burma (1867)	38

bos, Linn.; Fl. Br. Ind. ii. 474; Roxb. Fl. Ind. ii. 494; Bedd. Fl. Sylv. For. Fl. 233; Kurz For. Fl. i. 495; Gamble Darj. List 40; Talbot Bomb. Rose Apple. Vern. *Guláb jaman,* Hind.; *Malle nerale,* Coorg.

tree. *Wood* brown, rather soft, with fairly regular wavy lines of loose texture. *Pores* small to moderate-sized, usually in radial or oblique lines. *Medullary rays* fine, bent round the pores.

ys, "indigenous in the Sikkim Terai," but I never saw it wild there, ten cultivated, as it is elsewhere all over the Indian plains. Its native btful.

s rather poor, better for its scent than for its flavour; but the tree itself are pretty and worth growing for ornament.

's Sections, vol. 5 (*Myrtus Jambosa,* H.B.K.).

lehii, Wight; Fl. Br. Ind. ii. 475; Gamble Darj. List 40. *E. præcox,* ii. 488; Kurz For. Fl. i. 483.

evergreen tree. *Wood* brown. *Pores* moderate-sized,

often subdivided, the partition often oblique, arranged in more or less prominent concentric bands. *Medullary rays* of two classes: few moderately-broad, short, alternating with several fine and longer.

Sikkim Terai, Dúars and Assam; Eastern Bengal and Chittagong; Mergui.
Nordlinger's Sections, vol. 9.

5. E. grandis, Wight; Fl. Br. Ind. ii. 475; Bedd. Fl. Sylv. cvii.; Kurz For. Fl. i. 489. *E. cymosa*, Roxb. Fl. Ind. ii. 492. Vern. *Jam*, Beng.; *Batti jamb*, Sylhet; *Zebri*, Magh; *Taungthabye*, *thabyegyi*, Burm.

An evergreen tree. *Wood* red, rough, hard. *Pores* small, joined by fine, wavy, concentric lines. *Medullary rays* fine, wavy, numerous, uniform and equidistant.

Eastern Bengal, Burma and the Andaman Islands.

		lbs.
B 314.	Burma (1867)	51
B 2256.	Andaman Islands (Col. Ford, 1866)	52

B 2713, 48 lbs., brought from Tavoy by Dr. Wallich in 1828, has the same structure and is probably this species.

6. E. Kurzii, Duthie; Fl. Br. Ind. ii. 478; Kurz For. Fl. i. 491; Gamble Darj. List 40. Vern. *Jaman*, Nep.; *Sunóm*, Lepcha.

A large evergreen tree. *Bark* $\frac{1}{3}$ in. thick, greyish-white. *Wood* reddish-grey, moderately hard, rough. *Pores* moderate-sized, numerous, often subdivided, arranged in conspicuous, wavy, concentric bands. *Medullary rays* fine and moderately broad, numerous.

Eastern Himalaya, common in the Darjeeling hill forests at 3–6000 ft.; Assam, the Khasia and Mishmi Hills, Cachar; hills of Martaban.

		lbs.
E 701.	Sepoydura Forest, Darjeeling, 5500 ft. (Johnston)	56
E 2955.	Tukdah Forest, Darjeeling, 5000 ft. (Gamble)	37 (young)

7. E. læta, Ham.; Fl. Br. Ind. ii. 479; Talbot Bomb. List 94. *E. Wightii*, Bedd. Fl. Sylv. cix.

A small or medium-sized tree. *Wood* grey, hard. *Pores* small in rough, very narrow, concentric rings. *Medullary rays* very fine, very numerous.

Forests of the Western Ghâts, common about Gairsoppah, extending down to Travancore.

Bourdillon gives W = 55 lbs., P = 759.

		lbs.
W 4621.	Travancore (Bourdillon)	58

SUBGENUS 2. SYZYGIUM.

8. E. Arnottiana, Wight; Fl. Br. Ind. iii. 483; Bedd. Fl. Sylv. cvii. Vern. *Nawal*, Tam.; *Nagay*, Badaga; *Naga*, Mal.; *Ayri*, Trav. Hills.

A large tree. *Bark* grey, rough. *Wood* greyish-brown or yellowish-brown, hard, close-grained. *Pores* moderate-sized, numerous, often subdivided, arranged in narrow, wavy, concentric bands. *Medullary rays* of two classes, few moderately broad, separated by many fine, the intervals between the latter much less than the diameter of the pores which the rays usually pass round. Occasional medullary patches.

Hills of S. India; in the "shola" forests of the Nilgiris, Anamalais, Pulneys and hills of Travancore above 4000 ft.

One of the chief trees of the "sholas," and perhaps the one whose timber is most in demand. Bourdillon gives W = 58 lbs., P = 594.

		lbs.
W 3731, 3938.	Coonoor, Nilgiris, 6000 ft. (Gamble)	52
W 3766.	Aramby Shola, Ootacamund, 7000 ft. (Gamble) . . .	63
W 3900.	Ootacamund, Nilgiris	58
W 4609.	Travancore (Bourdillon)	59

9. E. montana, Wight; Fl. Br. Ind. ii. 488; Bedd. Fl. Sylv. cvii. Vern. *Poo nagay*, Badaga.

A large evergreen tree. *Bark* brown, ¼ in. thick, granulated outside and peeling off in very small flakes. *Wood* greyish-brown, sometimes with a yellowish tinge, moderately hard. *Pores* moderate-sized, rather obscurely arranged in wavy thin radial bands. *Medullary rays* fine to very fine, numerous. *Annual rings* marked by a line of few or no pores.

S. India: sholas of the Nilgiri Hills, above 5000 ft.

A large tree with shining foliage, found at high elevations. Growth rather fast. Timber good, used for building. Bourdillon gives W = 44 lbs., P = 489.

		lbs.
W 3856.	Aramby Shola, Ootacamund, 7000 ft. (Gamble) . . .	42
W 4670.	Travancore (Bourdillon).	41

10. E. lissophylla, Thw.; Fl. Br. Ind. ii. 488; Bedd. Fl. Sylv. cviii.; Talbot Bomb. List 95; Trimen Fl. Ceyl. ii. 173. Vern. *Maha kuretiya*, Cingh.

A moderate-sized tree. *Bark* thin, smooth, pale brown. *Wood* reddish-brown, rough, moderately hard. *Pores* moderate-sized to large, joined by irregular faint transverse bands. *Medullary rays* fine, numerous, inconspicuous.

Western Coast from the Konkan to Travancore; low country of Ceylon up to 2000 ft.

		lbs.
W 4670.	Travancore (Bourdillon).	39

11. E. caryophyllæa, Wight; Fl. Br. Ind. ii. 490; Bedd. Fl. Sylv. cviii.; Talbot Bomb. List 95. *E. corymbosa*, Lamk.; Trimen Fl. Ceyl. ii. 174. Vern. *Ranlavang*, Mar.; *Dán, hindán*, Cingh.

A shrub or small tree. *Bark* smooth, grey. *Wood* brown, rather soft. *Pores* moderate-sized and large, often subdivided. *Medullary rays* fine, very wavy from being bent round the pores.

Western Coast in the Konkan, N. Kanara and Travancore, near the sea; also Ceylon.

The black fruit is eaten.

Nordlinger's Sections, vol. 7 (*Myrtus caryophyllata*, L.).

Note.—I have felt a little in doubt whether Nordlinger's specimen did not really belong to the "Clove"—*Eugenia caryophyllata*, Thunb., but his collection contains so few plants of the further East, and so many from India or Ceylon, that I have come to the conclusion that it is most probably this species, for which *Myrtus caryophyllata*, Linn. is given as a synonym in Fl. Br. Ind.

12. E. sylvestris, Wight; Fl. Br. Ind. ii. 493; Bedd. Fl. Sylv. cvii.; Trimen Fl. Ceyl. ii. 175. Vern. *Alubo*, Cingh.

A large tree. *Bark* smooth, yellowish-grey. *Wood* reddish-brown, moderately hard. *Pores* moderate-sized to large, often subdivided, arranged in more or less conspicuous wavy concentric belts. *Medullary rays* fairly numerous, fine, bent round the pores.

Ceylon, up to 3000 ft.

The timber is used in housebuilding and for cart-axles and ploughs.

		lbs.
No. 1.	Ceylon Collection, new (A. Mendis)	49

13. E. calophyllifolia, Wight; Fl. Br. Ind. ii. 494; Bedd. Fl. Sylv. cvii.

An evergreen tree. *Bark* ¼ in. thick, brown, rough. *Wood* reddish-brown, hard, close-grained. *Pores* small, often subdivided, in groups in loose tissue, the groups joined into wavy concentric bands. *Medullary rays* very fine, numerous and close.

South India: "sholas" of the Nilgiris above 6000 ft.

This tree is very conspicuous in the Nilgiri sholas, having a rather twisted bole with a rounded head of small leaves, in appearance like the "*Kina*" tree of Newera Ellia in Ceylon (*Calophyllum Walkeri*). The wood is good and strong and used for building. The Ceylon plant joined with this by Duthie in the Fl. Br. Ind. is *E. Fergusoni*, Trimen.

		lbs.
W 4051.	Elk Hill, Ootacamund, 7500 ft. (Gamble)	45

14. E. alternifolia, Wight; Fl. Br. Ind. ii. 497; Bedd. Fl. Sylv. t. 198. Vern. *Manchi moyadi, mogi, manchi mogi, movi*, Tel.

A large tree. *Wood* dark red, hard, close-grained. *Pores* small, rather scanty, joined into faint concentric bands. *Medullary rays* very fine, numerous, short, showing a fine silver-grain.

Deccan Hills; chiefly in the Nallamallai hills of Kurnool and the Veligondas of Cuddapah and North Arcot.

An important tree, the timber much esteemed and in considerable demand for building purposes.

		lbs.
D 3937.	Cuddapah Forests (Higgens)	58

15. E. tetragona, Wight; Fl. Br. Ind. ii. 497; Kurz For. Fl. i. 484; Gamble Darj. List 40. Vern. *Kemma, chamlani*, Nep.; *Sunóm*, Lepcha.

A large evergreen tree. *Wood* brownish- or olive-grey, shining, hard. *Pores* moderate-sized, numerous, uniformly distributed, oval and subdivided. *Medullary rays* fine, visible on a radial section, in a silver-grain.

East Himalaya from Nepal eastwards at 4–6000 ft., very common between Kurseong and Darjeeling; Khasia Hills, Sylhet and hills of Upper Burma.

The wood is occasionally used for building and for the handles of tools, but chiefly for charcoal.

		lbs.
E 682.	Sepoydura Forest, Darjeeling, 5500 ft. (Johnston)	46
E 1446.	Mishmi Hills (Griffith, 1836)	—

16. E. operculata, Roxb. Fl. Ind. ii. 486; Brandis For. Fl. 234; Kurz For. Fl. i. 482; Gamble Darj. List 40; Trimen Fl. Ceyl. ii. 179. *E. nervosa*, DC; Bedd. Fl. Sylv. cvi. Vern. *Rai jáman, paiman, jamawa*, Hind.; *Piamanthuti*, Dehra Dún; *Dúgdúgia*, Oudh; *Kiamoni*, Nep.; *Jungsong, songnam*, Lepcha; *Boda jam*, Mechi; *Topa*, Kól; *Monisia jamu, panapoki*, Khond; *Bata-damba, kobo-mal*, Cingh.; *Yethabye*, Burm.

A moderate-sized evergreen tree, leaves turning red in the cold season. *Bark* grey or light brown, rough, with irregular hard scales, leaving cavities when they exfoliate. *Wood* reddish-grey, hard, rough. *Pores* small to moderate-sized, often in radial lines, joined into faint concentric bands. *Medullary rays* very fine, closely packed, very numerous. Numerous minute fine dark concentric lines visible on a transparent section.

Sub-Himalayan forests from the Punjab to Assam, ascending to 3000 ft.; Eastern Bengal; Orissa and the N. Circars; Burma, extending north to Kachin Hills; South India and Ceylon. Common in grass lands in Northern India.

A conspicuous tree, useful in reclothing grassy blanks in the Sál and mixed forests

in Northern India. The wood is not so good as that of the Jaman, but is useful and employed for building and agricultural implements. The fruit is eaten. W = 47 lbs.

			lbs.
O	334.	Gorakhpur (1868)	51
E	584.	Khookloong Forest, Darjeeling Terai (Manson)	51
C	4214.	Ganjam Forests (Gamble)	43
B	305.	Burma (1867)	43
		Ceylon Collection, No. 8 (A. Mendis)	45
		Nordlinger's Sections, vol. 9.	

17. **E. Jambolana,** Lam.; Fl. Br. Ind. ii. 499; Roxb. Fl. Ind. ii. 484; Bedd. Fl. Sylv. t. 197; Brandis For. Fl. 233, t. 30; Kurz For. Fl. i. 485; Gamble Darj. List 41; Talbot Bomb. List 95; Trimen Fl. Ceyl. ii. 179. Vern. *Jáman, jam, phalinda, jamni, phaláni, pharenda, phaunda,* Hind.; *Jam,* Beng.; *Jamo, jambo, kudijamu,* Uriya; *Phober, taglang,* Lepcha; *Chambu,* Gáro; *Kor-jam,* Mechi; *Jamu,* Ass.; *Naval, navvel, nawar, naga,* Tam.; *Nerale,* Mysore; *Narula, nairul, nerlu,* Kan.; *Nasedu, nairuri, nareyr, neredu,* Tel.; *Naindi,* Gondi; *Jambúl,* Mar.; *Jambu,* Merwara; *Kodo, kúd,* Sonthal; *Kuda,* Kól; *Jambún,* Oraon; *Lohudru,* Khond; *Neredu,* Reddi; *Nerel,* Badaga; *Mahadan, ma-dan,* Cingh.; *Zebri, chaku, kau,* Magh; *Thabyebyu,* Burm.

An evergreen tree usually with a rather crooked stem and many branches. *Bark* ¼ in. thick, light grey, with large patches of darker colour, smooth, with shallow depressions caused by exfoliation. *Wood* reddish-grey, rough, moderately hard, darker near the centre, no distinct heartwood. *Annual rings* generally marked by a line with few or no pores. *Pores* moderate-sized and small, numerous, frequently oval elongated and subdivided, joined together in wavy concentric belts of loose pale tissue. *Medullary rays* fine, numerous; the interval between the rays less than the diameter of the pores, round which they bend.

Throughout India, Burma and Ceylon; in the sub-Himalayan tract and Lower Himalaya from the Indus eastwards, ascending in Kumaon to 5000 ft.; in the Nilgiris up to 6000 ft.; often cultivated for its fruit and in avenues and topes.

The Jaman is chiefly found along river-banks and in the forests in the moister localities: it is an important and useful tree with a good timber, reproduces well and gives a good shade. It is easy to grow, but the seed must not be kept, as it very quickly loses its power of germination. It is perhaps best to sow it at site, or to sow it in baskets, for it does not bear transplanting very well, certainly not without the earth around the roots. It is one of the best of the avenue trees, and if the cultivated varieties with large fruit are used, it ought to be made a source of some profit. It is often planted near temples and is sacred to Krishna. The fruit is astringent, but is not at all bad in tarts and puddings.

The weight of the wood, according to Skinner, No. 120, is 48 lbs. per cubic foot; according to Kyd (*Saljam?*) 45 lbs.; the average of the specimens (24) gives 48 lbs. Skinner gives P = 600, Kyd P = 577. The wood is fairly durable, witness five sleepers laid down on the Oudh and Rohilkhand railway in 1870 and taken up in 1875, which were found to be fairly sound and not touched by white ants. It is largely used for native building purposes, posts, beams and rafters of houses, etc.; for agricultural implements, rice-mortars and carts, and for well work, as it resists the action of water well. It gives a good fuel. Dr. Leather determined its calorific power as 85·4 compared with carbon 100; and showed that 1 lb. of the wood would evaporate 12·81 lbs. of water at 212° F. His analysis gave: moisture, 7·26 per cent.; carbon and other organic matter, 89·66 per cent.; and ash, 3·08 per cent.

It is one of the trees on which the "tásar" silkworm is fed. The bark has been used in dyeing and tanning, especially combined with "*Mánjit*" (*Rubia cordifolia*) and *Gorán* (*Ceriops*). It is used in medicine as a specific for dysentery. Other parts of the plant are also used in native medicine.

The scale insect, *Aleurodes Eugeniæ*, Mask., does much damage to its leaves in the Deccan.

The var. *caryophyllifolia* is recognized by its acuminate leaves and small fruit, the size of a large pea.

		lbs.
P 1192.	Madhopur, Punjab (F. Halsey)	40
P 452.	Ajmere	44
O 527, 535.	Dehra Dún (O'Callaghan)	59 and 64
O 209, 210, 211, 224, 239,	Garhwal (1868)	average 46
O 2993.	Garhwal (1874)	47
O 875.	Mohan Forest, Kumaon Bhabar (Campbell)	58
O 337, 338.	Gorakhpur (1868)	51 and 42
C 195.	Mandla, C.P. (1870)	52
C 1135.	Ahiri Reserve, Chanda, C.P. (R. Thompson)	56
C 2761.	Mohanli Reserve, C.P. (Brandis)	43
C 1251.	Gumsúr Forests, Ganjam (Dampier)	57
C 4212.	Ganjam Forests (wood yellowish-brown) (Gamble)	47
E 664.	Rakti Forest, Darjeeling Terai (Manson)	54
E 2377, 3598.	Sivoke Forest, Darjeeling Terai (Gamble)	44
E 1396, 1958.	Chittagong Hill Tracts (Chester)	48
E 413.	Sundarbans (Richardson)	—
B 3065.	Burma (1862)	52
No. 51, Ceylon Collection, old; No. 88, new (Mendis)		36

Nordlinger's Sections, vol. 7 (Tab. VIII. 2).

18. E. Heyneana, Wall.; Fl. Br. Ind. ii. 500; Talbot Bomb. List 95. *E. salicifolia*, Wight; Bedd. Fl. Sylv. cix.; Brandis For. Fl. 234. Vern. *Pan jambúl, bedas*, Mar.; *Hendi*, Gondi; *Gambu*, Kurku; *Garakúda*, Kól; *Jamti*, Kharwar.

A large shrub or small tree with grey *bark*. *Wood* similar to that of *E. Jambolana*, but pores smaller.

Western Coast in the Konkan and N. Kanara; Berar, the C. P. and Chota Nagpore; Orissa and the N. Circars, common in the beds of rivers and along streams.

		lbs.
C 2786.	Melghát, Berar (Brandis)	38
C 3439.	Ramundag Res., Palamow, Chota Nagpore (Gamble)	—

In this latter the concentric bands are more prominent.

SUBGENUS 3. EUEUGENIA.

19. E. bracteata, Roxb. Fl. Ind. ii. 490; Fl. Br. Ind. ii. 502; Bedd. Fl. Sylv. cx.; Trimen Fl. Ceyl. ii. 182. Vern. *Hijuli mendi*, Beng.; *Sagarabatna*, Uriya; *Arivita, aramanda, goragmúdi*, Tel.; *Kaya, venkalikaya*, Tam.; *Tembiliya*, Cingh.

A shrub or small tree. *Bark* yellowish-grey, smooth. *Wood* hard, close-grained, grey. *Pores* small and extremely small, joined by concentric bands of white tissue, which are closely packed. *Medullary rays* very fine, very numerous.

Forests of the Coromandel Coast, in Orissa, the Circars and Carnatic, as a shrub; Anamalai Hills up to 3000 ft. as a small tree (Bedd.); coasts of Ceylon; often cultivated for ornament.

A myrtle-like shrub with white flowers and red berries, very common at Striharikota, near Madras.

C 3582. Khurdha Forests, Orissa (Gamble).

20. E. kanarensis, Talbot in Journ. Bomb. Nat. Hist. Soc. xi. 236, t. 4.

A large tree. *Bark* smooth, white. *Wood* dark reddish-brown, very hard. *Pores* small, in patches of pale tissue joined by very fine, wavy, concentric but interrupted lines. *Medullary rays* very fine, numerous.

Forests of Kanara and Travancore, discovered by Talbot on the Gairsoppah Ghát at 2000 ft.

No. B 316, Burma (1867), 55 lbs. per cubic foot; Vern. *Thabye*, Burm., is a hard, close-grained red wood, with small pores joined into concentric bands, and fine, numerous medullary rays. The species is not known.

No. E 2199, Assam, 43 lbs. per cubic foot, with wood resembling that of *E. Jambolana*, is perhaps *E. mangifolia*, Wall.

No. B 2292, Andamans (Col. Ford, 1866), 56 lbs., is a moderately hard, compact grey wood, with structure similar to that of *E. Jambolana*. It may be either *E. claviflora*, Roxb., *E. zeylanica*, Wight, or *E. javanica*, Lamk.

W 4583 (53 lbs.) and W 4599 (55 lbs.) are Travancore woods sent by Bourdillon without specific names. They are deposited in the Forest Museum at Dehra Dún, like the others.

Tribe III. LECYTHIDEÆ.

11. BARRINGTONIA, Forst.

Contains about nine species, chiefly from Burma. *B. speciosa*, Forst.; Fl. Br. Ind. ii. 507; Roxb. Fl. Ind. ii. 636; Bedd. Fl. Sylv. cxii.; Kurz For. Fl. i. 496; Trimen Fl. Ceyl. ii. 189; Vern. *Kyèyyi*, Burm.; *Doddá*, Andamans; *Mudilla*, Cingh., is an evergreen tree of the sea-shore of the Andamans, also found, but scarce, on the southern coast of Ceylon. It has a very large quadrangular fruit, which is carried long distances by sea and thrown up on the Indian shores. Prain says it is common on Great Coco, Little Andaman and Batti Malv, and that the bark is used as a fish-poison. *B. pterocarpa*, Kurz For. Fl. i. 498; Fl. Br. Ind. ii. 509; Vern. *Kyè*, Burm., is an evergreen tree of the tropical forests of Pegu and Martaban. Four other species are described as found in Tenasserim, viz. *B. conoidea*, Griff., *B. augusta*, Kurz, *B. Helferi*, Clarke, and *B. macrostachya*, Kurz (including *B. pendula*, Kurz). *B. zeylanica*, Gardn.; Fl. Br. Ind. ii. 508; Trimen Fl. Ceyl. ii. 190; Vern. *Goda-midella*, Cingh., is a rare endemic tree of the S. Ceylon coast.

Wood soft. *Pores* small, in short radial lines between the numerous broad, or moderately broad, *medullary rays*.

1. **B. racemosa,** Blume; Fl. Br. Ind. ii. 507; Roxb. Fl. Ind. ii. 634; Bedd. Fl. Sylv. cxii.; Kurz For. Fl. i. 496; Talbot Bomb. List 95; Trimen Fl. Ceyl. ii. 189. Vern. *Nivár*, Mar.; *Kumia*, Beng.; *Samudra, cuddapah*, Tam.; *Samstravádi*, Mal.; *Diya midella*, Cingh.; *Kyè*, Burm.

A moderate-sized evergreen tree. *Wood* white, very soft, porous. *Pores* small and moderate-sized, numerous, uniformly distributed. *Medullary rays* moderately broad, long, equidistant.

Western Coast, coast of the Sundarbans, the Andaman Islands and Ceylon. It is mentioned from Assam by G. Mann in Assam Forest Report, 1874–75. Vern. *Kumringah*, Ass., but *B. acutangula* may have been meant.

Skinner, No. 21, gives W = 53 lbs. (?) per cubic foot, and P = 819; he also says the wood is used for house and cart-building, and that it has been tried for railway sleepers. All this is unlikely, so it is probable that he had not got the right identification. There is no reason to doubt Kurz' specimen, as if any one knew the tree, he did, and his collections were all personally made; so that the idea of the wood being "strong and serviceable," repeated by various authorities, requires some further investigation. Heinig, in the "Sundarbans Working Plan," says, "wood white, soft, used 'only for firewood." It is a handsome tree, and is planted in and about Colombo for ornament.

	lbs.
B 1993. Andaman Islands (Kurz, 1866)	27

2. **B. acutangula,** Gaertn.; Fl. Br. Ind. ii. 508; Roxb. Fl. Ind. ii. 635; Bedd. Fl. Sylv. t. 204; Brandis For. Fl. 235; Kurz For. Fl. i. 497; Talbot Bomb. List 95; Trimen Fl. Ceyl. ii. 191. Vern. *Ijal, samundar phúl, panniári, ingar*, Hind.; *Injar, panniha*, Oudh; *Hijál, samundar*, Beng.; *Kinjolo, hinjolo, hinjara*, Uriya; *Hendol*, Ass.; *Kanapa, batta, kurpá, kadamic*, Tel.; *Piwar, tivar, ingli*, Mar.; *Ijar*, Monghyr; *Saprung*, Kól; *Atta péra*, Mal.; *Adampu*, Tam.; *Ela midella*, Cingh.; *Kyèni*, Burm.

A moderate-sized evergreen tree. *Bark* ½ in. thick, dark brown, rough. *Wood* white, shining, soft, even-grained. *Pores* small, often

rarely fine and moderately broad, long *medullary rays*, which form the greater part of the wood, and show a handsome silver-grain on a radial section.

Sub-Himalayan tract from the Jumna eastwards; Oudh, Bengal, Central and South India; Ceylon; Burma; always in swampy places or on the banks of streams.

A conspicuous tree from its long pendent racemes of pink tasselled flowers. The wood is more durable than it seems at first sight; it is used for boat-building, well-work, carts, rice-pounders, and by cabinet-makers. If cut so as to show the silver-grain to the best advantage, it would make good furniture, as it apparently does not warp much, if so cut. The bark is used to intoxicate fish, also for tanning; and, as well as the leaves and fruit, in native medicine. Beddome says the wood turns black when buried in mud.

Weight: Skinner, No. 20, gives 56 lbs.; while Kyd's experiments (*Stravadium acutangulum*) give only 39·3 lbs. The specimens give 32 to 46, average 39 lbs. Benson's experiments with bars of Burma wood 3 ft. × 1·4 in. × 1·4 in. gave P = 648; Skinner P = 863, while Kyd's experiments on Assam wood in bars 2 ft. × 1 in. × 1 in. gave P = 315.

		lbs.
O 4524.	Forest School Garden, Dehra Dún (Gamble)	32
C 3470.	Saranda Forests, Chota Nagpore ,, ...	—
C 1132.	Ahiri Reserve, Central Provinces (R. Thompson)	—
B 814.	Burma (Ribbentrop)	46
B 4899.	Minbu, Burma (Calthrop)	40

Nordlinger's Sections, vol. 10 (Tab. VIII. 3).

B 5045 from Bassein, and B 5056 from Thongwa, Burma, have been received as *B. pterocarpa*, Kurz. They have a *bark* ¼ in. thick, light brown, smooth at first, afterwards shallowly vertically cleft. *Wood* as in *B. acutangula*, but darker-coloured and with the pores a little larger. They probably belong to that species.

12. CAREYA, Roxb.

Besides the species described, *C. sphærica*, Roxb. Fl. Ind. ii. 636; Fl. Br. Ind. ii. 511; Kurz For. Fl. i. 500, is a large deciduous tree of the Chittagong Hills; and *C. herbacea*, Roxb. Fl. Ind. ii. 638; Fl. Br. Ind. ii. 510; Brandis For. Fl. 237; Gamble Darj. List 41; Vern. *Bhooi dalim*, Beng.; *Chuwa*, Nep., is a small undershrub of grass lands in Bengal, Oudh and the Central Provinces, generally bringing out its beautiful pink flowers in April, and best after the grass has been burnt by jungle fires.

1. C. arborea, Roxb. Fl. Ind. ii. 638; Fl. Br. Ind. ii. 511; Bedd. Fl. Sylv. t. 205; Brandis For. Fl. 236; Kurz For. Fl. i. 499; Gamble Darj. List 41. Vern. *Kumbi, kumbh, khumbi*, Hind.; *Pilu*, Banda; *Gumar*, Mandla, Balaghát; *Kumri*, Chhindwara; *Gummar*, Gondi; *Boktok*, Lepcha; *Dambel*, Gáro; *Ijar*, Monghyr; *Kúmbi*, Uriya; *Kumbé*, Khond; *Asunda*, Kól; *Kúm*, Bhumij; *Budatare*, Koya; *Darepi*, Reddi; *Ayma, pailae, poota-tammi*, Tam.; *Budá-durmi, buda darini, dudippi*, Tel.; *Kumbia, kuba*, Mar.; *Kaval, gaul, ganjal*, Kan.; *Pera, udu*, Mal.; *Poyn*, Trav. Hills; *Gavuldu*, Mysore; *Banbwè*, Burm.; *Kabooay*, Taleing; *Tagooyi*, Karen; *Kahatta*, Cingh.

A large deciduous tree, leaves turning red in the cold season. *Bark* ½ in. thick, dark grey, with vertical and diagonal cracks, exfoliating in narrow flakes; inner substance reddish, fibrous. *Wood* moderately hard: sapwood whitish, large; heartwood dull red, sometimes claret-coloured, very dark in old trees, even-grained. *Pores* oval, moderate-sized to large, subdivided, wavy on a vertical section. *Medullary rays* numerous, fine, equidistant and uniform; the space between two consecutive rays less than the diameter of the pores, round which they bend. Across the medullary rays are numerous very fine transverse bars, not easily seen except on a thin section.

Throughout India, in moist forests and in ravines and valleys, scarce in the dry mixed forests: sometimes alone in grass lands. It is found in the sub-Himalayan

tract from the Jumna eastwards to Assam, the Khasia Hills and Eastern Bengal; throughout Burma in mixed forests; throughout Central, Western and Southern India; in the moist regions of Ceylon up to 5000 ft., and especially on exposed "patana" land.

This is an important tree with a fine wood which is too much neglected. It is common in Sál forests, and is conspicuous by its large leaves. It is a good ornamental tree for avenues and gardens. In suitable places it grows to a large size, but in savannah or patana lands it remains stunted and poor.

The weight and transverse strength of the wood have been determined by the following experiments:—

Experiment by whom conducted.	Year.	Wood whence procured.	No. of experiments.	Size of scantling.	Weight.	Value of P.
				ft. in. in.	lbs.	
Wallich . . .	—	Goalpara	—	—	43	—
Adrian Mendis .	1855	Ceylon	—	—	38	—
R. Thompson . .	1869	Central Provinces	—	—	60	—
Skinner, No. 38 .	1862	South India	—	—	50	870
Benson . . .	—	Burma	—	3 × 1·4 × 1·4	47	929
Brandis, No. 52, 53 .	1862	"	—	—	55	—
" . .	1864	"	4	3 × 1 × 1	60	880
" . .	"	"	5	2 × 1 × 1	51	655
Kyd . . .	1831	Assam	1	2 × 1 × 1	61	670
Commt. Dept. . .	—	Moulmein	—	—	50	950
Bourdillon . .	1896	Travancore	—	—	65	562
Specimens examined	1878–99	See list below	16	—	53	—

The wood is durable; the specimens brought by Dr. Wallich from Tavoy in 1828, and that brought from the Mishmi Hills by Dr. Griffith in 1836, were quite sound on being cut up, though they had been stored for so long in Calcutta. The wood is little used except for agricultural implements. Kurz says it is used in Burma for gun-stocks, house-posts, planking, carts, furniture and cabinet-work. Heinig says that it is sold in the Andamans as a second-class wood, squaring up to 30 ft. with 2 ft. siding, but is difficult to season. It stands well under water. Fuzes made from its bark are used to make slow-matches. Its bark gives a good fibre for coarse, strong cordage, and is used in native medicine as an astringent. Careya is one of the trees most subject to the attacks of the defoliating Lymantriid moth, *Dasychira Thwaitesii*, Moore.

		lbs.
O 208, 228.	Garhwal (1868)	53
O 1479.	Kheri, Oudh	59
C 1131.	Ahiri Reserve, Central Provinces (R. Thompson) . . .	58
C 2747.	Moharli Reserve " " (sapwood) (Brandis) . .	37
E 624.	Rakti Forest, Darjeeling Terari (Bonham-Carter) . . .	48
E 2378.	Sivoke " " " (Gamble)	51
E 1441.	Mishmi Hills (Griffith, 1836)	56
B 2703, 2685, 2710.	Tavoy (Wallich, 1822)	59, 56, 51
B 2228.	Andaman Islands (Col. Ford, 1866)	55
B 3147.	" " (Home, 1874)	56
D 4003.	Cuddapah (Higgens)	60
W 4194.	Cochin (Kohlhoff)	57
No. 41, old, 58, new,	Ceylon Collection (A. Mendis)	38

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13. PLANCHONIA, Bl.

1. **P. littoralis**, Van Houtte; Fl. Br. Ind. ii. 511. *P. valida*, Blume; Kurz For. Fl. i. 500. Vern. *Banbwè-ni*, Burm.; *Baila dá*, And.

An evergreen tree. *Wood* reddish-brown, with yellow specks, very hard, close-grained. *Pores* moderate-sized and large, often subdivided, in rounded and elongated patches, which are sometimes

joined by narrow, undulating bands of softer tissue. *Medullary rays* very fine, numerous, bending. The pores are frequently filled by a yellow substance, and are prominent on a vertical section.

Evergreen coast forests of the Andaman Islands.

Weight: the specimens give 61 to 64 lbs. per cubic foot; Bennett gives 56 lbs. and P = 600. A valuable wood, which should be better known; it seasons well and takes a fine polish.

		lbs.
B 514.	Andaman Islands (Genl. Barwell)	64
B 2495.	„ „ (Home, 1874, No. 7, *Youaygyee*) . . .	61

ORDER XLIX. MELASTOMACEÆ.

An Order containing 13 Indian genera of shrubs or small trees. They are chiefly found in South India or Tenasserim. They belong to five Tribes, viz.—

Tribe I. Osbeckieæ	Osbeckia, Otanthera, Melastoma.
„ II. Oxysporeæ	Oxyspora, Kendrickia, Allomorphia, Blastus, Ochthocharis, Anerincleistus.
„ III. Medinilleæ	Anplectrum, Medinilla.
„ IV. Astronieæ	Pternandra.
„ V. Memecyleæ	Memecylon.

Among these genera only one is of any forest importance, viz. *Memecylon*, and even that only contains shrubs or small trees giving scarcely anything but fuel, though that is of the best quality.

1. OSBECKIA, Linn.

A genus containing a number of shrubs and herbaceous plants with handsome, large, usually purple or crimson flowers. They are conspicuous plants, and some of them are shrubs of fair size but of no forest importance. *O. buxifolia*, Arn.; Trimen Fl. Ceyl. ii. 197, is a large round bush of interesting appearance, being very woolly and bearing small hard leaves and purple flowers. It is common round the summit of Pedrotallagalla in Ceylon.

1. O. crinita, Benth.; Fl. Br. Ind. ii. 517; Gamble Darj. List 41. Vern. *Number*, Lepcha.

A shrub. *Bark* greyish-brown, smooth. *Wood* light brown, moderately hard. *Annual rings* marked by a white line and more numerous pores. *Pores* moderate-sized, scanty. *Medullary rays* crooked, fine, the distance between the rays equal to the diameter of the pores.

Eastern Himalaya and Khasia Hills at 4–8000 ft.

A very pretty shrub, common about Darjeeling.

E 3310. Darjeeling, 6000 ft. (Gamble).

2. OTANTHERA, Blume. Two shrubs of small size: *O. moluccana*, Bl.; Fl. Br. Ind. ii. 522 (*O. bracteata*, Korth.; Kurz For. Fl. i. 502) of Tenasserim; and *O. nicobarensis*, Teysm. and Binn. of the Nicobar Islands.

3. MELASTOMA, Linn.

Shrubs. Four species. *M. imbricatum*, Wall. is a large shrub of Eastern Bengal, and *M. Houtteanum*, Naud., a bushy shrub of the eastern slopes of the Pegu Yoma and of Tenasserim.

1. M. malabathricum, Linn.; Fl. Br. Ind. ii. 523; Roxb. Fl. Ind. ii. 405; Kurz For. Fl. i. 503; Gamble Darj. List 41; Talbot Bomb. List 96; Trimen Fl. Ceyl. ii.

199. The Indian Rhododendron. Vern. *Choulisy*, Nep.; *Tungbram*, Lepcha; *Shapti, tunka*, Mechi; *Phutuka*, Ass.; *Paloré*, Mar.; *Maha-bowitiya*, Cingh.; *Myetpyè*, Burm.

A large shrub. *Bark* reddish-brown, thin, smooth. *Wood* moderately hard, light brown, with medullary patches. *Pores* moderate-sized, often in concentric groups and surrounded by pale tissue. *Medullary rays* short, fine to moderately broad, numerous, unequally distributed.

Throughout India, Burma and Ceylon, up to 6000 ft., chiefly near watercourses, but not in the dry region of the Punjab, Sind, Rajputana and the Deccan.

A handsome shrub with large red-purple flowers. It is probably the *Lutki* bush on which, according to Mr. Brownlow of Cachar (*Journ. of the Agri-Hort. Soc. of Calcutta*), the silkworm *Attacus Atlas* is often found, and fed on which it gives a very white silk. E. Stack mentions it as a food-plant of *Antheræa Paphia*.

E 3275. Borojhar Reserve, W. Dúars (Gamble).

2. **M. normale,** Don; Fl. Br. Ind. ii. 524; Kurz For. Fl. i. 504.

A large shrub. *Wood* similar to that of *M. malabathricum*.

East Himalaya, from Nepal to Assam, at 2–6000 ft.; Khasia Hills, Shan Hills and hill forests of Martaban up to 5000 ft.

E 3665. Rinkinpúng Forest, Darjeeling, 3000 ft. (Gamble).

4. OXYSPORA, DC.

Large shrubs. Three species. *O. vagans*, Wall., and *O. cernua*, Triana, are found in the Mishmi Hills, Khasia Hills and Chittagong.

1. **O. paniculata,** DC; Fl. Br. Ind. ii. 525; Gamble Darj. List 41.

A large handsome shrub with red flowers. *Bark* reddish-brown, thin. *Wood* light reddish-grey, moderately hard, with dark brown medullary patches. *Pores* small to moderate-sized, scanty, often in short radial lines. *Medullary rays* fine, short, numerous, not straight. Concentric bands of soft tissue, often interrupted, prominent.

East Himalaya from Nepal eastwards, at 3–7000 ft.; Khasia Hills, at 3–5000 ft., very common.

E 3419. Lebong, Darjeeling, 5000 ft. (Gamble).

5. KENDRICKIA, Hook. f. *K. Walkeri*, Hook. f.; Fl. Br. Ind. ii. 526; Trimen Fl. Ceyl. ii. 200, is a scandent epiphytic shrub of the Anamalai Hills in South India and the lower hills of Ceylon. Trimen says it is "a very lovely plant when in flower, the mode of climbing being precisely like that of ivy."

6. ALLOMORPHIA, Blume. Two species. *A. umbellulata*, Hook. f.; Fl. Br. Ind. ii. 527; Kurz For. Fl. i. 506, of the Andamans and Mergui Archipelago, and *A. hispida*, Kurz, of the forests of Martaban, both evergreen shrubs.

7. BLASTUS, Lour. *B. cochinchinensis*, Lour.; Fl. Br. Ind. ii. 528, is a shrub of Assam and Eastern Bengal.

8. OCHTHOCHARIS, Blume. *O. javanica*, Blume; Fl. Br. Ind. ii. 528; Kurz For. Fl. i. 507, is a low-branched evergreen erect shrub of Tenasserim.

9. ANERINCLEISTUS, Korth. Two species. *A. Helferi*, Hook. f. and *A. Griffithii*, Hook. f.; Fl. Br. Ind. ii. 529; Kurz For. Fl. i. 507, both large shrubs of Tenasserim.

10. ANPLECTRUM, A. Gray. *A. glaucum*, Triana; Fl. Br. Ind. ii. 545 (*A. cyanocarpum*, Kurz For. Fl. i. 508), is an evergreen half scandent shrub of the forests of Martaban and Tenasserim.

11. MEDINILLA, Gaud.

Several shrubs, usually epiphytic, with showy flowers.

1. **M. himalayana,** Hook f.; Fl. Br. Ind. ii. 549.

An epiphytic shrub. *Bark* light brown, corky. *Wood* soft, grey. *Pores* very small, scanty. *Medullary rays* numerous, very fine, of light colour.

Sikkim Himalaya and the Khasia Hills at 3–6000 ft., where also *M. rubicunda*, Bl.; Gamble Darj. List 42, is found.

E 3666. Rissoom, Darjeeling Hills, 6000 ft. (Gamble).

The wood of *M. rubicunda*, Bl. is similar but rather harder and of a yellowish-red colour. (Khasia Hills—Kew Museum (J. D. Hooker).)

12. PTERNANDRA, Jack.

P. capitellata, Jack; Fl. Br. Ind. ii. 551; Kurz For. Fl. i. 509, is an evergreen shrub of Tenasserim, said, in Fl. Br. Ind., to be doubtfully distinct from the following.

1. **P. cærulescens,** Jack; Fl. Br. Ind. ii. 551; Kurz For. Fl. i. 509.

An evergreen small tree. *Wood* light brown, soft to moderately hard, with scattered, small, very numerous patches of (apparently) bast tissue through which the medullary rays pass, and which, on a vertical section, resemble the pores. *Pores* small, irregular, scattered. *Medullary rays* very fine, numerous, regular.

Tenasserim in Burma; Straits Settlements.

Singapore—Kew Museum (Ridley, 1897).

13. MEMECYLON, Linn.

A large genus, the description of the species of which has proved difficult to most botanists who have studied it. C. B. Clarke, in Fl. Br. Ind., admits that he had difficulty in distinguishing many of the species, so that under *M. edule*, Roxb. he has included several forms which other botanists like Kurz and Trimen have recognized as species. In this work, which is not one of critical descriptive botany, it will be best simply to adhere to the Fl. Br. Ind. and not to attempt the subdivision of the species *edule*. The Fl. Br. Ind. describes 35 species, of which no less than 21 are from Ceylon, 15 of them endemic; 9 species are South Indian, 3 of Eastern Bengal and 10 Burmese. With few exceptions, the Ceylon species are uncommon and unimportant.

M. grande, Retz; Fl. Br. Ind. ii. 557; Trimen Fl. Ceyl. ii. 221; Vern. *Dodanwenna, dedi-kaha*, Cingh., is a large shrub or small tree with smooth grey bark found in Ceylon, but also extending to Eastern Bengal and Burma. *M. amabile*, Bedd. is a small tree of the Ghâts of S. Kanara. *M. pauciflorum*, Blume; Kurz For. Fl. i. 514, is a tree of Chittagong, Tenasserim and the Andamans. *M. Heyneanum*, Benth. is a tree of South India and Ceylon, as is also *M. angustifolium*, Wight. They are all ornamental plants usually with bright blue small flowers in clusters.

Wood very hard, close-grained, brown. *Pores* small, in irregular groups. *Medullary rays* many, extremely fine to fine.

1. **M. edule,** Roxb. Cor. Pl. t. 82; Fl. Br. Ind. ii. 563; Bedd. Fl. Sylv. cxiii.; Kurz For. Fl. i. 512; Roxb. Fl. Ind. ii. 260; Talbot Bomb. List 97—*including M. umbellatum*, Burm.; Bedd. Fl. Sylv. t. 206; Trimen Fl. Ceyl. ii. 216; *also M. capitellatum*, Linn.; Trimen Fl. Ceyl. ii. 222, t. 41. Vern. *Nirása*, Uriya; *Alli*, Tel.; *Anjun, anjuni, kurpa*, Bombay; *Udatalli*, Kan.; *Kaya, kassau*, Tam.; *Kora-kaha, weli-kaha, dodan-kaha*, Cingh.

A small tree. *Bark* thin, light brown, corky, narrowly cleft vertically. *Wood* light brown, very hard, close-grained. *Pores* small, in groups of soft tissue roughly connected in a concentric pattern, and so

showing belts of dark and light colour. *Medullary rays* of two kinds, the larger fine and short, the smaller extremely fine.

Forests of the Coromandel coast from Orissa southwards; also those of the Malabar coast from the Konkan southwards; the Deccan; Ceylon; Burma.

It is believed that all the specimens examined belong to *M. edule*, var. *typica*, and none to *M. umbellatum* and *M. capitellatum*, which I believe to be distinct species, as, although it may be difficult to find good separating characters from the flowers and fruit, the plants in actual growth differ considerably. The wood of all is an excellent fuel, and makes good charcoal; it is also used for house-posts in the Deccan and Carnatic. It is an important constituent of the Carnatic dry evergreen forests, and even in the sandy forests of Point Calimere in Tanjore it gives an excellent coppice growth.

		lbs.
C 3561.	Khurdha Forests, Orissa (Gamble)	60
C 3829.	Kurcholy Forests, Ganjam „	—
D 3939.	Striharikota, Nellore (Gamble)	58
W 4632.	Travancore (Bourdillon)	56

Ceylon Collection, No. 153 (new) (Mendis) is called *M. capitellatum*. It has a rather different structure, the *pores* not being in groups but singly, and the *wood* softer.

2. **M. amplexicaule,** Roxb. Fl. Ind. ii. 260; Fl. Br. Ind. ii. 559; Talbot Bomb. List 97; var. *malabarica*, Clarke. Vern. *Limba*, Mar.; *Locundi, limbtoli*, Kan.

A small tree. *Bark* brown, very thin, peeling off in long narrow flakes. *Wood* greyish-brown, very hard, close-grained. *Pores* small, in groups (clouds !) more or less concentrically arranged. *Medullary rays* few fine and many very fine.

Forests of the Nilgiris and other hills of S. India at 4–6000 ft.

Common and conspicuous from its bright blue flowers, this well-marked species affects rather damp sholas. The wood is only used for fuel.

		lbs.
W 3728.	Coonoor, Nilgiris, 6000 ft. (Gamble)	65
W 4285.	Hulikal „ 5000 ft. „	65

ORDER L. LYTHRACEÆ.

Nine genera, all belonging to the Tribe LYTHREÆ, viz. Woodfordia, Pemphis, Lawsonia, Crypteronia, Lagerströmia, Duabanga, Sonneratia, Punica and Axinandra. Some of the genera, like Lagerströmia, Duabanga and Sonneratia, contain trees of forest importance and giving valuable woods. That of the *Jarúl* or *Pyinma* (*Lagerströmia Flos-Reginæ*) is one of the finest of Indian timbers, and those of several other *Lagerströmias* are nearly as good. *Duabanga* has a useful soft wood. Many of the trees of the Order are exceedingly ornamental.

Lagerströmia* is characterized by *pores* of various sizes, joined by loose tissue forming more or less concentric bands. The other genera have mostly softer woods, with *pores* in radial lines. In all, *medullary rays* fine, regular, numerous.

1. WOODFORDIA, Salisbury.

1. **W. floribunda,** Salisb.; Fl. Br. Ind. ii. 572; Brandis For. Fl. 238; Gamble Darj. List 42; Talbot Bomb. List 98; Trimen Fl. Ceyl. ii. 226. *W. tomentosa*, Bedd. Fl. Sylv. cxvii. *W. fruticosa*, Kurz For. Fl. i. 518. *Grislea tomentosa*, Roxb. Fl. Ind. ii. 233. Vern. *Dáwi, thawi, santha, dhaula*, Hind.; *Gul daur*, Kangra; *Dhai, dhuiya, dhaulo*, Kumaon; *Dhiuti*, Oudh; *Dhuvi, surtári*, C.P.; *Pitta, petisurali, surteyli*, Gondi; *Khinni, dhi, dhin*, Kurku; *Dahiri, laldairo*, Nep.; *Chungkyek dum*, Lepcha; *Jatiko, dhatiko, harwari*, Uriya; *Jargi*, Tel.; *Phulsatti, dayti, dhaiphal*, Mar.; *Datti*, Bhil; *Dhauri, dowari*, Bombay; *Daor, dhin*, Berar; *Icha*, Kól, Sonthal; *Dadki*, Bhumij; *Potá beluri*, Khond; *Kerani*, Palkonda; *Jaji*, Reddi; *Malitta*, Cingh.; *Yetkyi*, Burm. (Chindwin); *Paule*, Burm. (Mogaung).

A large deciduous shrub with much-fluted stem. *Bark* exceedingly thin, grey, peeling off in thin scales. *Wood* reddish-white, hard, close-grained; often several annual rings of hard wood, alternating with a layer of bast tissue, and then more rings of wood irregularly disposed. *Pores* small, uniformly distributed, rather scanty. *Medullary rays* fine and very fine, closely packed.

Common throughout India, ascending to 5000 ft. in the Himalaya; rare in the south, not extending further south than the hills of Kurnool; Shan Hills and other forests in Upper Burma as far south as Prome; rare in Ceylon.

A conspicuous shrub on dry hillsides and in rocky places, with red flowers.

Cunningham gives weight 58 lbs., P = 730; specimens examined weigh 46 and 62 lbs. The flowers give a red dye, which is used to dye silks.

		lbs.
O 4813.	Siwalik Hills, Saharanpur (Gradon)	62
C 4218.	Ganjam Forests (Gamble)	—
C 2794.	Melghát, Berar (Brandis)	46
E 876.	Chenga Forest, Darjeeling Terai (Manson)	—

2. PEMPHIS, Forst. *P. acidula*, Forst.; Fl. Br. Ind. ii. 573; Bedd. Fl. Sylv. xvii.; Kurz For. Fl. i. 518; Trimen Fl. Ceyl. ii. 227 (*P. angustifolia*, Roxb. Fl. Ind. ii. 465), is an evergreen shrub of the sea-coast of India, Burma, the Andaman and Cocos Islands and Ceylon, with thick fleshy leaves.

3. LAWSONIA, Linn.

1. **L. alba,** Lam.; Fl. Br. Ind. ii. 573; Bedd. Fl. Sylv. cxviii.; Brandis For. Fl. 238; Gamble Darj. List 42; Talbot Bomb. List 98; Trimen Fl. Ceyl. ii. 228. *L. inermis*, Linn.; Roxb. Fl. Ind. ii. 258; Kurz For. Fl. i. 519. The Henna plant of Egypt. Vern. *Mehndi*, Hind.; *Manghati*, Uriya; *Marithondi*, Tam.; *Gorantlu*, Kan.; *Henne, mendie*, Bombay; *Dan*, Burm.

A deciduous shrub. *Bark* thin, greyish-brown. *Wood* grey, hard, close-grained; alternate bands of tissue, with fewer and more numerous pores, which may possibly be annual rings. *Pores* small and joined by faint, short, interrupted concentric bands. *Medullary rays* fine.

Wild in Baluchistan, on the Coromandel coast and perhaps in Central India and the Deccan, but doubtful.

Cultivated throughout India as a hedge plant and for its leaves, which, powdered and made into a paste, give the "henna" dye which is used to dye the nails, skin and beard. Flowers fragrant.

C 2000. Nimar, Central Provinces (Brandis).
D 4258. Striharikota, Nellore (Gamble).

4. CRYPTERONIA, Blume.

Two species which Kurz and King consider as varieties of one: *C. paniculata*, Bl.; Kurz For. Fl. i. 519.

1. **C. pubescens,** Blume; Fl. Br. Ind. ii. 575. Vern. *Anambo*, Burm.

A tree. *Wood* light reddish-brown, moderately hard. *Pores* moderate-sized, scanty, usually subdivided radially. *Medullary rays* very numerous, fine, red, inconspicuous.

Pegu and Tenasserim in Burma.
Burma—Kew Museum (Prof. Oldham, F.R.S.).

2. **C. glabra,** Blume; Fl. Br. Ind. ii. 575.

A large tree. *Bark* light greyish-brown, very thin, smooth. *Wood* as in *C. pubescens*, but softer.

Khasia Hills, at 1–3000 ft.; Chittagong, 1000 ft.
Khasia Hills—Kew Museum (J. D. Hooker).

5. LAGERSTRÖMIA, Linn.

Eleven species described in Fl. Br. Ind. *L. Rottleri*, Clarke; Fl. Br. Ind. ii. 576, is a South Indian tree, apparently scarce. *L. calyculata*, Kurz; Fl. Br. Ind. ii. 576; Kurz For. Fl. i. 522, is an evergreen tree of the tropical forests of Martaban, with a brown, heavy close-grained wood. *L. floribunda*, Jack; Fl. Br. Ind. ii. 577; Kurz For. Fl. i 522; Vern. *Pyinmabyu*, Burm., is an evergreen small tree of the tropical forests of Upper Tenasserim. *L. venusta*, Wall.; Fl. Br. Ind. ii. 576, is a scarce Burmese species.

Wood greyish- or reddish-brown, moderately hard. *Pores* of various sizes, joined by narrow bands of loose tissue (larger wood-cells), prominent on the vertical section. *Medullary rays* fine, numerous, uniform, usually bent round the pores. The woods of all are fairly uniform in structure and quality, and are useful timbers in considerable demand.

1. **L. indica,** Linn.; Fl. Br. Ind. ii. 575; Roxb. Fl. Ind. ii. 505; Kurz For. Fl. i. 521; Talbot Bomb. List 98. Vern. *Telinga-china*, Hind.; *Saungbale*, Yaw.

A small deciduous tree. *Bark* grey, smooth, very thin. *Wood* white or light brown, hard. *Pores* small to moderate-sized, rather scanty. *Medullary rays* fine, uniform, equidistant. Numerous regular, pale concentric bands.

Indigenous in China; commonly cultivated throughout India.

A pretty garden shrub or small tree, flowers of various shades, white pink, lilac, etc.

	lbs.
Forest School Garden, Dehra Dún (Gamble)	42
Nordlinger's Sections, vol. 7.	

2. **L. parviflora,** Roxb.; Fl. Br. Ind. ii. 575; Roxb. Fl. Ind. ii. 505; Bedd. Fl. Sylv. t. 31; Brandis For. Fl. 239; Kurz For. Fl. i. 521; Gamble Darj. List 42; Talbot Bomb. List 98. *L. lanceolata*, Bedd. Fl. Sylv. t. 32. Vern. *Bákli, kat dhaura, dhaura, adhuari, lendya, seina, sida, asid*, Hind.; *Sida*, Beng., Mechi, Ass.; *Bordheri, bordengri*, Nep.; *Kanhil*, Lepcha, *Shida*, Gáro; *Shej*, Banda; *Seji*, Bijeragogarh; *Kakria*, Guz.; *Sahine*, Chanda; *Chakrej*, Kurku; *Chinangi*, Tel.; *Chungi, pilúgu*, Hyderabad; *Nana, bondara, nandi, bellinandi, sina, sokutia, lendi*, Mar.; *Ventaku, cheninge*, Kan.; *Lendya*, Baigas; *Sina, nelli, leria*, Gondi; *Chekerey*, Kurku; *Sidha*, Uriya; *Nahua*, Khond; *Sianangi*, Palkonda; *Saikre*, Kól, Southal; *Tsambelay*, Burm.

A large deciduous tree. *Bark* light brown, thin, exfoliating in long, thin, woody scales. *Wood* very hard, grey or greyish-brown, often almost red, darker-coloured near the centre, hard. No *annual rings*. *Pores* moderate-sized and large, often subdivided, surrounded singly or in patches by pale rings, which are joined by fine, narrow, irregular, wavy, interrupted and anastomozing bands of loose texture. *Medullary rays* fine, very numerous, inconspicuous. The pores are conspicuously visible on a longitudinal section.

Common in deciduous forest almost all over India, except in the very dry regions. It is common in the sub-Himalayan forests and Lower Himalaya from the Sutlej (or even further west!—Brandis says the Jumna, but I feel sure it occurs, at any rate, in the Kyarda Dún and Kalesar Forests) to Assam; also throughout Central India and down both coasts, getting gradually more scarce, and apparently ending in the Nilgiris (Beddome mentions the Sigúr forest north of the Nilgiris, but I think I have seen it in the Coonoor Valley).

An important tree both economically and sylviculturally. In the latter point of view, it is important as one of the best timbers of the mixed forests; and as being, except *Terminalia tomentosa*, the most important of the usual associates of Sál. On dry hill ranges like the Siwaliks, the hills of the Central Provinces and the Deccan, it is abundant and useful, as it reproduces well, though it does not grow very big; but in the Sál forests and in mixed forests in fairly damp localities like the Dúns and the

Terai, it grows of a large size, and is an excellent tree to retain in mixture with the Sál. Economically, it is important as giving the kind of material which is in demand for the supply of the native population; house-posts, beams and rafters, frames for doors and windows, pieces for agricultural implements, carts and boats. For big works, the wood ought to be more used than it is; but as, in the localities where it is common, there are usually more important woods like Teak, Sál, Sissoo available, it has not been much in demand. It has been tried for sleepers, and the results were favourable; but not being a gregarious tree, it cannot be supplied in quantity. The following experiments have been made with the wood:—

	Weight in lbs.	P
Kyd, in 1831, specimens from Assam, in bars 2′ × 1″ × 1″, gave	52	757
Skinner, No. 86, „ S. India, in various sizes . „	40	467

The average weight of the specimens examined is 53 lbs. per cubic foot, which is probably a fair weight to adopt.

It is an excellent fuel tree, and gives very good charcoal. Dr. Leather's experiments gave an analysis of dry wood—

Moisture	10·95 per cent.
Carbon and other organic matter . . .	86·15 „
Ash	2·90 „

while its calorific power was 83·5 per cent. of that of pure carbon, and 1 lb. of the wood evaporated 12·34 lbs. of water at 212° Fahr.

The bark has been employed in tanning, chiefly as a black colouring agent. It also gives a fibre occasionally used for rough ropes. The gum is sweet and edible. The tasar silkworm will feed on the leaves.

		lbs.
O 232.	Garhwal (1868)	45
O 2999.	„ (1874)	51
O 339.	Gorakhpur (1868)	54
C 196.	Mandla, Central Provinces (1870)	49
C 2735, 2749.	Moharli Reserve, Central Provinces (Brandis) . . .	50
C 1140.	Ahiri Reserve, Central Provinces (R. Thompson) . . .	60
C 2768.	Melghát, Berar (Brandis)	54
C 3547.	Khurdha Forests, Orissa (Gamble)	—
C 956.	Guzerat, Bombay (Shuttleworth)	—
E 666.	Bamunpokri, Darjeeling Terai (Manson)	52
E 2379, 3611.	Sukna Forest, Darjeeling Terai (Gamble)	54
E 785.	Kámrúp, Assam (Mann)	—
W 1220.	North Kanara (Barrett)	57

These last two are var. *majuscula*, Clarke, while the Darjeeling Terai and Assam specimens are probably var. *benghalensis*, Clarke.

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3. L. lanceolata, Wall.; Fl. Br. Ind. ii. 576; Brandis For. Fl. 240. *L. microcarpa*, Wight; Bedd. Fl. Sylv. t. 30; Talbot Bomb. List 99. Vern. *Benteak, venteak*, Tam.; *Ventaku*, Tel.; *Bolundúr, billi nandi*, Kan.; *Nana*, Mar.; *Senjál*, Mal.; *Venda, vengalam*, Trav. Hills.

A large deciduous tree. *Bark* white, smooth, peeling off in thin flakes like paper. *Wood* red or reddish-brown, moderately hard. *Annual rings* fairly distinct. *Pores* small to large, often subdivided and in patches or singly, joined by narrow irregular transverse wavy bands of soft texture, much narrower than in *L. parvifolia*. *Medullary rays* very fine, very numerous, bent round the small pores, and either bent round or ending in the larger ones. Pores conspicuous on a longitudinal section.

Western Coast of India, in deciduous forest, from Bombay to Travancore, ascending into the hill ranges of Mysore, Coorg, the Nilgiris, etc.

A valuable and important timber tree, much in request, and giving one of the best of the woods of Western India. It grows to a large size, and is very abundant, and is

used for building purposes, ships, coffee-cases and furniture. The growth is moderately fast, being about 6 to 8 rings per inch of radius. Foulkes, in "Notes on Timber Trees in S. Kanara," says it prefers gneiss soils to laterite, and does best in the low Ghát forests, where the rainfall is fairly heavy; also that, though uncertain of natural reproduction, it grows fast when once started, and gets a bole 60 to 80 ft. high. The weight and transverse strength have been determined as follows:—

Experiment by whom conducted.	Year.	Whence procured.	No. of experiments.	Size of bar.	Weight.	Value of P.
				ft. in. in.	lbs.	
Skinner, No. 85	1862	—	—	Various	41	619
Puckle	1859	Mysore	5	2 × 1 × 1	41	939
List	1863	"	—	—	39	—
Balfour	—	Malabar	3	7 × 2 × 2	49	542
Talbot	1885	Kanara	2	7 × 2 × 2	45	542
		"	4	6 × 2 × 2		515
H. H. O'Connell	1886	Coimbatore	3	Different	50	a = 0·01065
Bourdillon	1895	Travancore	—	—	43	596

		lbs.
W 765, 862.	South Kanara (Cherry)	48
W 4143.	Anamalai Hills, Coimbatore	45
W 4543.	Travancore (Bourdillon), much sapwood	38

4. L. Flos-Reginæ, Retz; Fl. Br. Ind. ii. 577; Kurz For. Fl. i. 524; Talbot Bomb. List 99; Trimen Fl. Ceyl. ii. 228. *L. Reginæ*, Roxb. Fl. Ind. ii. 505; Bedd. Fl. Sylv. t. 29; Brandis For. Fl. 240. Vern. *Jarúl*, Beng.; *Ajhar*, Ass.; *Bolashari*, Gáro; *Gara saikre*, Kól; *Taman, mota bondara*, Mar.; *Kadali, púmaruthu*, Tam.; *Challá hole dasál*, Kan.; *Adamboe, mani marutha, nir marutha*, Mal.; *Shem marutha*, Trav. Hills; *Kamaung*, Magh; *Eikmwè*, Upper Burma; *Pyinma, ye-pyinma*, Burm.; *Muruta*, Cingh.

A large deciduous tree. *Bark* smooth, grey to cream-coloured, peeling off in irregular flakes. *Wood* shining, light red, hard. *Annual rings* marked by a belt of large pores. *Pores* of all sizes from extremely small to large, the latter often subdivided, joined by narrow, wavy and often anastomozing concentric bands of soft tissue, which contain the smaller pores. *Medullary rays* very or extremely fine, often indistinct. The wood in Burma is frequently very porous with an abundance of large pores, that from India is more compact. Pores and bands prominent on a vertical section.

Assam Valley, Eastern Bengal and Chittagong; Chota-Nagpore and the Circars, but scarce; Western Coast from the South Konkan southwards; throughout Burma; moist low country of Ceylon; often cultivated.

The chief timber tree of Assam, Eastern Bengal and Chittagong, and one of the most important of the trees of Burma. It is chiefly found along river-banks and on low swampy ground, and is only sporadic and of less forest importance than if it were gregarious or grew in regular forest. It is very handsome when covered with its large lilac flowers, and is therefore commonly cultivated in gardens and avenues, but in the north of India it only grows as a small tree, with low branches and a rounded head. Even, however, at its best, it grows only crooked and knotty, and therefore there is considerable waste in the utilization of the wood. The natural reproduction does not seem to be always very good; and, in Chittagong at any rate, the tree seems to have a tendency to get scarce, for the large trees are felled to supply the demand for the timber, and there are few young ones to replace them. Similar experience has been reported from Assam. The seeds obtained from cultivated trees appear to germinate badly. The result is that, although giving a fine useful timber, the Jarúl tree is never likely to be important beyond its use for local requirements.

Growth moderate; the specimens show, on an average, 7 rings per inch of radius.

In 1876 Mr. W. R. Fisher measured five trees in the Sidli Forest, Goalpara District, Assam. The results were, on an average—

	In.	In.	In.	In.	In.
On a length of radius equivalent to a girth of	18	36	54	72	90
No. of rings	15	25	39	51	66

On an average, therefore, the number of rings per inch of radius is 4·6; and the tree appears to add a cubit to its girth every thirteen years on an average. The weight and transverse strength have been determined by the following experiments :—

Experiment by whom conducted.	Year.	Wood whence procured.	No. of experiments.	Size of bar.	Weight.	Value of P.
				ft. in. in.	lbs.	
Wallich	—	India	—	—	46·5	—
Adrian Mendis	1855	Ceylon	—	—	42	—
Baker.	1829	Bengal	11	2 × 1 × 1	—	850
Skinner, No. 87	1862	South India	—	—	40	637
Kyd	1831	Assam	—	2 × 2 × 1	37	407?
"	"	"	—	—	38	638
"	"	"	—	—	38	383?
Benson	—	Burma	—	3 × 1·4 × 1·4	38	849
Forbes Watson	—	"	—	3 × 1·5 × 1·5	36	651
Brandis, Nos. 61, 62 . . .	1862	"	—	—	40·5	—
" " " . . .	1864	"	4	7 × 2 × 2	47	680
Commissariat Department . .	—	Moulmein	—	—	38	822
Bourdillon	1895	Travancore	—	—	41	500
				Average . . .	40	

The specimens here enumerated give an average of 43 lbs. per cubic foot, so that the weight may be taken at 40 to 45 lbs. per cubic foot. The report on the timber made by Prof. W. C. Unwin, F.R.S., for the Imperial Institute, gives the following results (Agricl. Ledger, No. 9 (1897); "Ind. Forester," xxiv. 89) :—

Weight	41·77 lbs. per cubic foot.
Resistance to shearing along the fibres . . .	832·4 lbs. per square inch.
Coefficient of transverse strength	5·22 tons per square inch.
Coefficient of elasticity	544·1 " "
Crushing stress	2·762 " "

The timber is used for shipbuilding, for boats and canoes; for construction and carts. It has been used for gun-carriages and was recently recommended for gun-stocks, but the report was unfavourable. Beddome says that in Ceylon it is used for casks. The Ledger Report above quoted records that in the Garo Hills standing trees are sold at Rs.6 each; that in Sylhet and Cachar it is valued at Rs.1 per cubic foot. But excellent as the timber is, it will always have the disadvantage of the supply being limited, and that, owing to the tree only flourishing in restricted localities, its proper treatment and the extension of its growth are difficult matters. It is right here to mention Mr. C. W. Hope's paper on "Jarúl timber" in "Ind. Forester," vol. xl. 373, in which he condemns the wood as not being durable and as being readily attacked by white ants. However, it does not seem to be quite certain that the "red and white jarúl" to which he refers was really the wood of this tree.

		lbs.
E 630.	Eastern Dúars, Assam (G. Mann)	48
E 1228.	Sibsagar, Assam (G. Mann)	40
E 2188.	Nowgong, Assam "	40
E 1272.	Cachar (G. Mann)	38·5
E 410.	Sundarbans (Richardson)	47
E 710.	Chittagong (Chester)	47
E 3688.	Chittagong (Gamble)	52·5
W 726.	South Kanara (Cherry)	46
B 808.	Pegu (Ribbentrop)	39
B 3067.	Burma (Brandis, 1862)	40
B 2717.	Tavoy (Wallich, 1828)	42

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Nos. B 296, Burma (1867), 48 lbs., and B 3068, Burma (Brandis, 1862), 45 lbs., have a much redder wood, more open-grained, and with more prominent bands. They belong to *L. macrocarpa*, Wall.; Kurz i. 524, which is probably var. *angusta* of *L. Flos-Reginæ*. Vern. *Kôn pyinma*, Burm.

5. **L. hypoleuca,** Kurz For. Fl. i. 523; Fl. Br. Ind. ii. 577. Vern. *Pyinma*, Burm.; *Pábdá*, And.

A large deciduous tree. *Bark* thin, whitish. *Wood* red, hard. *Pores* very small to very large, in fine, wavy, concentric, anastomozing, but sometimes interrupted lines of soft tissue, alternating with darker wood of firmer texture, in which the very fine *medullary rays* are distinctly visible.

Andaman Islands, in the moister upper mixed forests.

Growth slow, 10 to 18 rings per inch of radius. Weight 41 to 50 lbs. according to Major Protheroe; Bennett gives 41 lbs. and P = 570; Heinig gives 38 to 48 lbs., and the specimens herein enumerated give an average of about 40 lbs. Heinig says the wood, after steeping in earth oil and gurjan oil mixed, is used for shingles; also for posts and frames, wall- and floor-planking, spokes and felloes of wheels. He also says it seasons well, is durable and seldom attacked by white ants, but as it swells when wet it is unsuited for boat-building. It squares up to 50 ft. in length with a siding of 2½ ft.

	lbs.
B 510. Andaman Islands (Gen. Barwell)	—
B 2202, 2274, 2283. Andaman Islands (Col. Ford, 1866)	45, 38 and 34
B 2496. Andaman Islands (Home, 1874, No. 2)	44

6. **L. villosa,** Wall.; Fl. Br. Ind. ii. 576; Kurz For. Fl. i. 524. Vern. *Yaunggalé*, Burm.

A moderate-sized tree. *Bark* light brown, ¼ in. thick (young tree) with irregular vertical clefts, fibrous within. *Wood* (young tree) whitish or greyish, with occasional irregular short concentric patches of bast tissue, somewhat as in *Woodfordia*, but not so broad or so long. *Annual rings* faintly marked, by a nearly continuous line of pores. *Pores* moderate-sized, surrounded by and joined together into more or less concentric rings by pale loose tissue. *Medullary rays* fine, numerous, the distance between them less than the diameter of the pores.

Tropical forests of Pegu, Martaban and Upper Burma.

	lbs.
B 4852. Pyinmana, Burma (G. E. Cubitt)	37
B 5039. Pegu Division, Burma	45
B 5097. Toungoo Division, Burma	40

7. **L. tomentosa,** Presl; Fl. Br. Ind. ii. 578; Kurz For. Fl. i. 522. Vern. *Lèza*, Burm.

A large deciduous tree. *Bark* ⅓ in. thick, grey. *Wood* grey or greyish-brown, close-grained, moderately hard. *Pores* from very small to very large, the latter often subdivided, joined by numerous concentric lines, alternating with broad bands of firmer tissue, in which the fine, wavy, numerous *medullary rays* are prominent. The medullary rays either pass round or stop short at the large pores.

Burma; frequent in Pegu and Martaban, also in Pyinmana and Mandalay in Upper Burma.

Weight, according to Brandis' Catalogue, 1862, No. 59 (*L. pubescens*, Wall.), 53 lbs.; Brandis' three experiments in 1864 with bars 3 ft. × 1 in. × 1 in. gave: Weight 58 lbs. and P = 588. The specimens give 46 and 53 lbs. The timber is valued for bows and spear-handles, and is also used for canoes and cart-wheels.

		lbs.
B 572.	Prome (Ribbentrop)	46
B 2533.	Burma (Brandis, 1862)	53

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6. DUABANGA, Ham.

1. **D. sonneratioides,** Ham.; Fl. Br. Ind. ii. 579; Kurz For. Fl. i. 525; Gamble Darj. List 42. *Lagerströmia grandiflora*, Roxb. Fl. Ind. ii. 503. Vern. *Bandorhulla*, Beng.; *Lampatia*, Nep.; *Dúr*, Lepcha; *Kochan*, *kokan*, Ass.; *Jarúl-jhalna*, Cachar; *Bondorkella*, *bolchim*, *achung*, Gáro; *Baichua*, Magh; *Myaukngo*, *mau-lettanshe*, Burm.

A lofty deciduous tree. *Bark* light brown, peeling off in thin flakes. *Wood* grey, often streaked with yellow, soft, seasons well, neither warps nor splits. *Pores* large and moderate-sized, often oval and subdivided, in roughly oblique lines. *Medullary rays* fine, very numerous, wavy. Pores well marked on a longitudinal section.

Eastern Himalaya, ascending to 3000 ft., Assam and Burma.

A very fine tree which is conspicuous in the Sikkim forests, having a tall bare stem often 80 ft. to the first branch and 100 ft. to the summit, with drooping branches and terminal flowers (see Hook. f. Ill. Him. Pl. t. 11). Growth fast, 5 rings per inch of radius, specimen No. E 3622 shows only 2 rings. Weight, according to Brandis' Burma List of 1862, No. 64, 30 lbs. per cubic foot; the specimens give an average of 32 lbs. The wood does not warp or split, and canoes cut out of it green are at once used, even when liable alternately to wet and to the heat of the sun. It is used in Northern Bengal and Assam for tea-boxes, for which purpose it is admirably fitted. It is also made into canoes and cattle-troughs. The seeds are extremely small and the seedlings very minute at first, but the growth is very fast. Seedlings at the Bamunpokri Plantation in Bengal, which had come up on the sites of old charcoal kilns (see "Indian Forester," iv. 345), attained a height of 10 ft. in two years, with proportionate girth and fine spreading branches.

		lbs.
E 652.	Rakti Forest, Darjeeling Terai (Manson)	32
E 2380.	Sukna Forest „ „ (Gamble)	32
E 3622.	Kalimpúng, Darjeeling, 2000 ft. „	—
E 950.	Eastern Dúars, Assam	32
E 1230.	Sibságar, Assam (Mann)	36
E 1436.	Assam	29
E 1285.	Cachar (Mann)	32
E 1499.	Sylhet „	—
E 713.	Chittagong (Chester)	31
B 807.	Pegu (Ribbentrop)	30
B 1995.	Andamans (Kurz, 1866) (young tree)	21

7. SONNERATIA, Linn. f.

Contains four Indian trees found in the coast forests of Sind, Bengal, S. India, Arracan, Pegu, Tenasserim and the Andamans. Besides the two described: *S. alba*, Sm.; Fl. Br. Ind. i. 580; Kurz For. Fl. i. 256; Trimen Fl. Ceyl. ii. 230, is found in the shore forests of the Andamans, and has been collected in Ceylon at Chilaw; and *S. Griffithii*, Kurz For. Fl. i. 527; Vern. *Tabyu*, is common in littoral forests in Burma.

Wood soft, even-grained. *Pores* small, oval and radially subdivided. *Medullary rays* very fine, very numerous. Root branches frequent and conspicuous.

1. **S. apetala,** Ham.; Fl. Br. Ind. ii. 579; Roxb. Fl. Ind. ii. 506; Bedd. Fl. Sylv. cxviii.; Kurz For. Fl. i. 527; Talbot Bomb. List 99; Trimen Fl. Ceyl. ii. 229. Vern. *Keowra*, Beng.; *Kylanki*, Tel.; *Marama*, Tam.; *Kanbala*, Burm.

A moderate-sized evergreen tree. *Bark* black, smooth, shining, with horizontal oval lenticels. *Wood*, moderately hard: sapwood

grey; heartwood reddish-brown. *Pores* small, numerous, oval and subdivided, in two to three sections. *Medullary rays* fine, very numerous, bent round the pores.

Tidal creeks and littoral forests of Bengal, the Konkan, the Coromandel Coast, and Burma; rare in Ceylon.

The wood is said by Kurz to be good for house-building, packing-boxes, etc., but Schlich ("Ind. Forester," i. 8) speaks of it as of little use except for planking and fuel. Heinig (Sund. Wg. Plan) says it is gregarious on banks of brackish rivers, chiefly east of the Raimangal, and that the wood is used for planks, furniture, boxes and parts of boats as well as for fuel. It gives slender upright root processes.

		lbs.
E 399.	Sundarbans (Richardson)	44
E 3699.	„ (Gamble)	40
D 4113.	South Arcot coast forests (Wooldridge)	33

2. S. acida, Linn. f.; Fl. Br. Ind. ii. 579; Roxb. Fl. Ind. ii. 506; Bedd. Fl. Sylv. cxviii.; Brandis For. Fl. 242; Kurz For. Fl. i. 526; Trimen Fl. Ceyl. ii. 230. Vern. *Orcha, ora, archaká*, Beng.; *Tapu, tamu*, Burm.; *Kinnai*, Tam.; *Kirilla*, Cingh.

A small evergreen tree. *Wood* grey, soft, even-grained. *Pores* small, oval and subdivided, very numerous, uniformly distributed. *Medullary rays* very fine, very numerous, bent round the pores.

Tidal creeks and littoral forests of India, Burma, Ceylon and the Andamans, extending westwards to the Indus delta. In the Sundarbans it affects the inner or northern portion.

The wood is said by Beddome to be used for models, and in Ceylon to be a good substitute for coal in steamers. The fruit is eaten in the Sundarbans. Trimen says of the erect root-branches, "as they attain 18 in. to 3 ft. in height and 3 in. in diameter, 'and have a soft, firm, even texture, they form a fine substitute for cork, and are cut 'into slices and used for entomologist's boxes and other purposes."

		lbs.
E 395.	Sundarbans (Richardson)	31
B 3379.	Kyoukphyoo, Arracan	42

No. 33, Ceylon Collection, new (Mendis).
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8. PUNICA, Linn.

1. P. Granatum, Linn.; Fl. Br. Ind. ii. 581; Roxb. Fl. Ind. ii. 499; Bedd. Fl. Sylv. cxix.; Brandis For. Fl. 241; Kurz For. Fl. i. 528; Talbot Bomb. List 99; Gamble Darj. List 42. The Pomegranate. Vern. *Anár, dárim, dál, daru, dháru*, Hind.; *Darun*, Simla; *Danoi*, Jaunsar; *Dálim, daram, darmi*, Kumaon; *Dalimbe*, Kan.; *Thalè*, Burm.

A shrub or small tree. *Bark* grey, thin, peeling off in small flakes. *Wood* light yellow, with a small darker-coloured irregular heartwood, hard, compact and close-grained. *Pores* very small, single or subdivided or in radial strings. *Medullary rays* very fine, very numerous. Medullary patches frequent.

Wild in the Suliman range, between 3500 and 6000 ft., Salt Range and West Himalaya. Cultivated in many parts of India and Burma.

Growth slow, 18 rings per inch of radius (Brandis). Weight: Mathieu Fl. For. p. 195, gives 52 to 63 lbs.; the specimens give 56 lbs. per cubic foot. The wood is not used, but might be tried as a substitute for boxwood. The fruit is generally eaten, but the best kinds come from Afghanistan. The flowers are very handsome, bright scarlet in colour, and give a light red dye; the bark and the rind of the fruit are used for tanning and dyeing leather, and the root-bark is an effectual anthelmintic.

		lbs.
P 106.	Sutlej Valley, Punjab	57
H 4706.	Bamsú, Tehri-Garhwal, 5000 ft. (Gamble)	55

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9. **AXINANDRA**, Thwaites. *A. zeylanica*, Thw.; Fl. Br. Ind. ii. 581; Trimen Fl. Ceyl. ii. 231; Vern. *Kekiriwara*, Cingh., is a rare endemic large tree of the moist low country of Ceylon, with a straight trunk, drooping branches and smooth pale brown bark.

ORDER LI. SAMYDACEÆ.

Three genera: Casearia, Osmelia and Homalium, all containing forest trees of more or less importance, the last including one of the finest of the timber trees of Burma.

Wood close-grained, generally rather rough. *Pores* small to moderate-sized, scanty, radially arranged between the fine, numerous *medullary rays*.

1. CASEARIA, Jacq.

Ten species. *C. coriacea*, Thw.; Fl. Br. Ind. ii. 592; Trimen Fl. Ceyl. ii. 237, is a scarce tree of the higher hills of Ceylon above 6000 ft. *C. rubescens*, Dalz.; Fl. Br. Ind. ii. 593; Talbot Bomb. List 100, is a shrub of the forests on the Ghâts of N. Kanara. *C. Vareca*, Roxb. Fl. Ind. ii. 418; Fl. Br. Ind. ii. 593; Kurz For. Fl. i. 530; Gamble Darj. List 42, is a small tree of the sub-Himalayan forests, in ravines and along streams from Nepal eastwards, the Khasia Hills up to 3000 ft., and the hills of Upper Burma. *C. wynadensis*, Bedd.; Fl. Br. Ind. ii. 593; Bedd. Fl. Sylv. cxx. is a small tree of the Western Ghâts in Nilgiris, Malabar and Travancore at 2–3000 ft. *C. Kurzii*, Clarke; Fl. Br. Ind. ii. 594 (*C. glomerata*, var. *puberula*, Kurz For. Fl. i. 530), is a small tree of the forests of Chittagong.

Wood yellowish-white, moderately hard, rough. *Pores* small or very small, in radial groups or lines. *Medullary rays* fine, numerous, the distance between them usually equal to the diameter of the pores.

1. **C. glomerata**, Roxb. Fl. Ind. ii. 419; Fl. Br. Ind. ii. 591; Kurz For. Fl. i. 530; Gamble Darj. List 42. Vern. *Lúrjúr*, Sylhet; *Burgonli, barkholi*, Nep.; *Sugvat*, Lepcha.

A large evergreen tree. *Wood* yellowish-white, moderately hard, rough. *Pores* small, in radial lines. *Medullary rays* of two sizes; numerous very fine rays between fewer moderately broad, giving a silver-grain on a radial section, the distance between them equal to the diameter of the pores.

Forests of the Himalaya from Nepal eastwards at 4–7000 ft.; Khasia Hills, Sylhet and hills of Upper Burma.

A common tree in the Darjeeling Forests; in forest it becomes a big tree, but on old cultivated lands it is a bush only associated with shrubby plants like *Mæsa*, *Saurauja*, etc. Manson (Darjeeling Working Plan, 1893) says it likes warm sunny aspects and is a capital nurse for restocking blanks. The wood is used for building, charcoal and occasionally for tea-boxes.

		lbs.
E 691.	Chuttockpur Forest, Darjeeling, 6000 ft. (Johnston) . .	48
E 2381.	" " " " (Gamble) . . .	45

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2. **C. graveolens**, Dalzell; Fl. Br. Ind. ii. 592; Brandis For. Fl. 243; Gamble Darj. List 43; Talbot Bomb. List 100. *C. Canziala*, Wall.; Kurz For. Fl. ii. 529. Vern. *Chilla, náro, kathera, pimpri*, Hind.; *Nara, nárha*, Dehra Dún; *Narra, nar, pinpriya*, Kumaon; *Nara, phempri*, Garhwal; *Kakri*, Dotiâl; *Tunki*, Lepcha; *Girchi*, Gondi; *Rewat*, Kurku; *Rawit*, Berar; *Benchu*, Koderma; *Newri*, Sonthal; *Béri*, Kól; *Béri*, Kharwar; *Veska*, Koya; *Giridi*, Uriya; *Bohkara*, Mar.

A small deciduous tree. *Bark* dark grey, with a few longitudinal wrinkles. *Wood* light yellow, moderately hard, rough, even-grained. *Pores* small, often oval and subdivided, in radial lines, rather larger than in *C. glomerata*. *Medullary rays* fine, equidistant, very

numerous, visible as a silver-grain, the distance between them equal to the diameter of the pores.

Sub-Himalayan tract from the Chenab eastwards; Oudh, Central India, Orissa and the Circars, also S. Konkan; lower mixed forests all over Burma.

Like other species, this tree is found both of fair size in the forests and in a bushy form in open places; the large leaves are conspicuous and turn red in winter. The wood is of poor quality and little or not at all used, but it has a good grain and should do for carvings, plates, etc., like the very similar wood of *Holarrhena.* The fruit is used to poison fish.

		lbs.
O 240.	Garhwal (1868)	42
O 271.	„ „	40
O 1456.	Bahraich, Oudh (Eardley-Wilmot)	49
O 3090.	Kheri, Oudh (Wood)	—

3. C. tomentosa, Roxb. Fl. Ind. ii. 421; Fl. Br. Ind. ii. 593; Bedd. Fl. Sylv. cxix.; Brandis For. Fl. 243; Talbot Bomb. List 100; Trimen Fl. Ceyl. ii. 238. Vern. *Chilla, chilara, bairi, bhari,* Hind.; *Beri, bhains ber,* Oudh; *Maun,* Manbhúm; *Men, wasa, gamgudu,* Tel.; *Lainja, massei, karei,* Mar.; *Girari,* Uriya; *Thundri,* Gondi; *Khesa,* Kirku; *Kanera,* Koderma; *Chorcho,* Sonthal; *Monkurokuri,* Mal Pahari; *Roré,* Kól; *Béri,* Khawar; *Gidugam,* Palhonda; *Veska,* Koya; *Jinuguda,* Reddi.

A small tree. *Bark* $\frac{1}{3}$ in. thick, brittle, exfoliating in more or less square flakes. *Wood* yellowish-white, moderately hard, rough, close-grained. *Pores* small and very small, in radial lines. *Medullary rays* fine and very fine, wavy, equidistant, very numerous, bent round the pores.

Sub-Himalayan tract from the Indus eastwards to Nepal; Oudh, Eastern Bengal, Central, Western and South India; very rare in Ceylon.

As with the other species, this also grows to a large size in forest and bushy in open lands, where, like the others, it probably owes its luxuriant growth to being disliked by goats. The wood is very similar to that of *C. graveolens,* and, like it, but little used. Brandis says combs are made of it. If cut green so as to prevent discoloration it ought to be good for carving. W = 40 lbs. The bark is bitter; it is used for adulterating the "Kamela" powder. The pounded fruit is used to poison fish. The leaves have been seen in the Dehra Dún to be covered with the bright green Hemipterous insect *Scutellera nobilis,* Fabr., which evidently sucks them, but the damage done was not very apparent.

		lbs.
O 1363.	Gonda, Oudh (Dodsworth)	41
O 3085.	„ „ (Wood)	—
O 3089.	Kheri, Oudh „	—
C 1183.	Ahiri Reserve, Central Provinces (R. Thompson)	41
C 2802.	Melghát, Berar (young) (Brandis)	38
C 3527.	Khurdha Forests, Orissa (Gamble)	43
C 4217.	Ganjam Forests (Gamble)	36

4. C. esculenta, Roxb. Fl. Ind. ii. 422; Fl. Br. Ind. ii. 592; Bedd. Fl. Sylv. cxix.; Talbot Bomb. List 100; Trimen Fl. Ceyl. ii. 237. *C. varians,* Thw.; Bedd. Fl. Sylv. t. 208. Vern. *Mori,* Mar.; *Kakkaipalai,* Tam.; *Wal-waraka,* Cingh.

A shrub or tree. *Wood* white, moderately hard, even-grained. *Pores* small, scanty, evenly distributed. *Medullary rays* fine, numerous, equidistant, giving a satiny silver-grain.

Western Coast from the Konkan southwards, and hills of the Western Ghâts up to 4000 ft.; common in Ceylon up to 5000 ft.

Beddome speaks of this as a large tree in the Western Ghát forests, and it probably has the same characteristics as the other species, being large in thick forest, and shrubby only in open places. Trimen says the wood and leaves are used medicinally, and the fruit is eaten in Ceylon.

		lbs.
W 4723.	Travancore (Bourdillon)	53

Fl. Ceyl. ii. 265. Vern. *Mainakat, hoongia*, Nep.; *Payomko*, Lepcha; *Bolong*, Gáro; *Sandugaza*, Beng.; *Bolúr, jermalu*, Kan.; *Ugado*, Mar.; *Chini*, Tam.; *Chini, vella chini*, Mal.; *Nigunu, mugunu*, Cingh.; *Tseikpoban*, Magh; *Baing*, Upper Burma; *Thitpôk*, Burm.

A very large deciduous tree, with cylindrical, often much-buttressed stem. *Bark* greyish-white, 1 in. thick, spongy, marked with horizontal wrinkles and small vertical lines of lenticels; peels off in thin papery layers. *Wood* white, soft. *Annual rings* marked by a belt of close pores. Wood cells large. *Pores* large, often subdivided and in short zigzag, transverse lines. *Medullary rays* fine to moderately broad, clearly marked, the distance between the rays equal to the diameter of the pores.

Eastern Himalaya in Sikkim and Bhutan, up to 2000 ft.; Gáro Hills; Chittagong Forests; tropical forests in the moist parts of Burma; plains and lower hills of the Western Coast from the Konkan to Travancore, up to 2500 ft.; low country of Ceylon, up to 3000 ft.

An immense, very conspicuous tree. Kurz says it reaches 150 ft., with 100 ft. to the first branch and 15 ft. in girth; and I have seen some in the lower Darjeeling hills of quite that height and about 30 ft. in girth. I also once measured a specimen in the Buxa forests 154 ft. high, with a girth of 15 ft. This is about the size mentioned by Bourdillon as reached by the tree in Travancore. The rate of growth is very fast, but unfortunately we have no recorded measurements. Kurz says the wood is valueless, but Bourdillon reports it to be used exclusively (? only) for dug-out canoes, and says that if rubbed with fish oil and used in salt water a boat will last for 8 to 10 years. It propagates itself readily from seed, the seeds being very small and easily carried by the wind. He gives W = 21 lbs., P = 321. The more correct weight is probably 24 lbs. per cubic foot.

		lbs.
E 3288.	Rinkheong Reserve, Chittagong Hill Tracts (Gamble)	—
W 4544.	Travancore (Bourdillon)	26
B 4861.	Yabé Reserve, Magwe (S. E. Jenkins)	—
B 4900.	Minbu Division (Calthrop)	24
B 5070.	Thaungyin Forests (Cappel)	30
B 5013.	Prome Division	18

ORDER LIV. CACTEÆ.

Two genera—Rhipsalis and Opuntia.

1. RHIPSALIS, Gaertn. *R. Cassytha*, Gaertn.; Fl. Br. Ind. ii. 658; Trimen Fl. Ceyl. ii. 266; Vern. *Wal-nawahandi*, Cingh., is a fleshy shrub growing on rocks, or epiphytic on trunks of trees in the moist region of Ceylon up to 4000 ft.

2. OPUNTIA, Mill. Prickly Pear. Several species of this genus have been introduced, and have, with sometimes disastrous results, escaped from cultivation, and now cover enormous areas in the Deccan and Carnatic. Apparently, Masulipatam was the place where the Cactus was first grown, and the species was *O. Dillenii*, DC; Vern. *Kalazaw, kalazaung*, Burm., which has glaucous green branches and bright yellow flowers. This, I believe, is the species which is probably the most common in the Northern Deccan and the Circars; but in the Carnatic country, around Madras, as Mr. Joseph Steavenson (*Proc. Madras Agri.-Hort. Soc.*, 1885) has pointed out, the common species is a red-flowered one, which is probably *O. spinosissima*, Mill. There are also several other species in cultivation or run wild, but their complete identification has never been fully carried out, and requires to be done.

The fruit of most species is more or less edible, and can be used for making alcohol; and the branch-joints, after their thorns have been cut off, have been chopped up and given to cattle in time of scarcity.

Prickly pear has sometimes been used for forest boundary hedges and to protect avenue trees on road-sides, but is not a good species for the purpose, as it is liable to spread. To the Forest officer the chief interest in it has been the hope that it would

assist in the reproduction of forest trees, by protecting the seedlings from cattle when young; but Mr. A. W. Peet tells me that this hope has hardly been fulfilled in the Madras forests. Seeds, however, often sow themselves naturally in the middle of Cactus bushes, or may be sown artificially by means of a long-handled hoe; and with the help of the prickly pear, some of the seed sown, especially nim, tamarind, babúl, soapnut, date, palmyra, may, it is hoped, germinate and the resulting trees eventually help to kill off their protector when he has served his purpose.

Various endeavours have been made to introduce the Cochineal insect and make Cochineal a regular article of Indian trade, but it is enough to refer to the very interesting history of the subject given in Dr. Watt's Dictionary, vol. ii. p. 398.

ORDER LV. UMBELLIFERÆ.

A large Order containing chiefly herbaceous plants, as types of which the cultivated vegetables, carrot, parsnip, celery, parsley may be indicated. Only one genus in India contains even a shrubby plant, and that is only locally interesting and of no economic importance.

1. BUPLEURUM, Linn.

1. **B. plantaginifolium,** Wight; Fl. Br. Ind. ii. 674.

A shrub with few stems, or a treelet 6 ft. high, running to scarcely more than 1 in. in diameter at base. *Bark* very thin, dark brown, with horizontal rings. *Wood* white, hard, close-grained. *Pores* extremely small, very scanty. *Medullary rays* very fine, very short, numerous.

Hill ranges of South India at 6–8000 ft., conspicuous in the sholas between Ootacamund and Doddabetta.

W 3994. Ootacamund, Nilgiris, 8000 ft. (Gamble).

ORDER LVI. ARALIACEÆ.

Contains 17 genera of usually small, soft-wooded trees or shrubs, erect or climbing. They are of little forest importance, none of them having any economic value, though some have good soft white woods which might serve for some carpentry purposes. They are divided into four Tribes, viz.—

Tribe I. Aralieæ	Aralia, Pentapanax, Aralidium.
„ II. Panaceæ	Acanthopanax, Helwingia, Polyscias, Heptapleurum, Trevesia, Brassaia, Dendropanax.
„ III. Hedereæ	Arthrophyllum, Heteropanax, Brassaiopsis, Macropanax, Hedera, Gamblea.
„ IV. Plerandreæ	Tupidanthus.

Panax fruticosum, Linn.; Fl. Br. Ind. ii. 725, is a shrub cultivated in gardens and as a hedge-plant all over India. The leaves vary much, and are often variegated.

Wood white, usually soft. *Pores* small, usually rather scanty; a line of larger pores often indicating the annual rings. *Medullary rays* moderately broad, not numerous, giving a silver-grain. The wood of *Aralidium* differs from that of the rest.

1. ARALIA, Linn. Eight species, some of which are scarcely woody plants. *A. foliolosa,* Seem.; and *A. armata,* Seem.; Fl. Br. Ind. ii. 723; Gamble Darj. List 43; Vern. *Somri,* Nep.; *Kajyang,* Lepcha, are small trees of the Eastern Himalaya and the Khasia Hills, the latter also occurring in Tenasserim and in the Kachin Hills. They have prickly stems, large 2- to 3-pinnate leaves, and the general aspect of tree ferns, and are decidedly ornamental. *A. Thomsonii,* Seem. is a similar plant of the Khasia Hills and Assam; while *A. malabarica,* Bedd. Fl. Sylv. cxxi., is also a somewhat similar species of the evergreen forests of the Western Ghâts, especially common on the Carcoor Ghât

below the Wynaad. *A. cachemirica*, Dcne.; Fl. Br. Ind. ii. 722; Brandis For. Fl. 248; Vern. *Akhota*, Jaunsar, is a large perennial herb which each year grows to almost shrubby size and then dies down; and which is a common and conspicuous plant of the undergrowth in the fir and oak forests of the West Himalaya.

A. papyrifera, Hook. is the Chinese rice-paper plant, and is often seen in gardens in India, especially on the Nilgiris.

2. PENTAPANAX, Seem.

Five species. *P. subcordatum*, Seem. is a small tree of the Khasia Hills at 4–6000 ft. *P. Leschenaultii*, Seem.; Fl. Br. Ind. ii. 724; Bedd. Fl. Sylv. cxxi., is a good-sized tree of the higher Sikkim Himalaya, also found on the Nilgiris and other hill ranges of South India. A variety of this (var. *umbellata*, Seem.; Vern. *Tungshing*, Bhutia) is met with in the Central and Eastern Himalaya from Kumaon to Bhutan at 4–10,000 ft., and in the Khasia Hills, and is a large climber with large paniculate umbels of flowers. *P. stellatum*, King in Journ. As. Soc. Beng. lxvii. ii. 293, is a climbing shrub of the Shan Hills of Burma.

1. **P. racemosum.** Seem.; Fl. Br. Ind. ii. 724; Gamble Darj. List 43. Vern. *Ballera*, Nep.; *Prongzam*, Lepcha.

A very large straggling or climbing shrub. *Bark* thin, silvery-grey, peeling off in thin flakes. *Wood* greyish-white, soft. *Annual rings* very prominently marked by a line of large pores; the *pores* in the rest of the wood small, scanty. *Medullary rays* moderately broad.

Sikkim Himalaya, 6–8000 ft., common about Darjeeling.

The Fl. Br. Ind. is doubtful if this is a tree or climber, but I have never seen it otherwise than climbing over other trees and throwing out many long pendent branches, which hang down conspicuously.

E 3576. Darjeeling, 6000 ft. (Gamble).

2. **P. parasiticum,** Seem.; Fl. Br. Ind. ii. 724; Brandis For. Fl. 248. Vern. *Kot semal*, Kumaon.

A straggling shrub, branches often rooting. *Bark* thin, dark grey, shining, exfoliating in thin flakes. *Wood* grey, soft, heartwood darker. *Pores* in the annual rings small, in a continuous belt; in the rest of the wood very small, in groups rather distant and radially disposed. *Medullary rays* scanty, fine to moderately broad.

West Himalaya from the Tons to Nepal, especially in Kumaon, at 6–9000 ft.

		lbs.
H 4640.	Balcha, Tehri-Garhwal, 9000 ft. (Gamble)	40

3. ARALIDIUM, Miq.

1. **A. pinnatifidum,** Miq.; Fl. Br. Ind. ii. 725. Vern. *Seinkasi*, Burm.

A small tree. *Wood* light red, hard. *Pores* scanty, moderate-sized to large, often subdivided or 2 to 3 together. *Medullary rays* broad to very broad, with a very conspicuous silver-grain of broad plates. Very numerous ladder-like curved transverse bars across the spaces between the rays.

Malay Peninsula, extending north to Tenasserim.

The plant was found by Mr. W. A. Hearsey on the western coast of Tavoy, on the hills. The wood-structure is quite unlike that of most ARALIACEÆ, but agrees closely with that of PROTEACEÆ. But I know of no Burmese tree of the latter Order having pinnatifid leaves nearly 4 ft. long by 3 ft. broad, as Mr. Hearsey describes those of his plant. It is a beautiful wood, and would make fine parquet flooring, tables, etc.

		lbs.
B 4924.	Tavoy, Burma (Manson)	34

4. **ACANTHOPANAX**, Dcne. and Planch. *A. aculeatum*, Seem.; Fl. Br. Ind. ii. 726, is a shrub or small tree of the Mishmi and Khasia Hills, frequent at 4000 ft. The structure of the wood of *A. ricinifolium*, Seem. of Japan, is very interesting, the large pores being in regular concentric lines, while the cellular tissue has a curious network of large cells (Nordlinger's Sections, vol. 10).

5. HELWINGIA, Willd.

1. **H. himalaica**, Hook. f. and Th.; Fl. Br. Ind. ii. 726; Gamble Darj. List 43. Vern. *Lubbor*, Lepcha.

A large shrub. *Wood* white, moderately hard, pith large. *Pores* very small, arranged in groups or short concentric lines. *Medullary rays* short, fine to moderately broad.

Eastern Himalaya, above 7000 ft., Khasia Hills.

A curious shrub with simple leaves and flowers in umbels from the centres of the leaves, like those of *Ruscus*. It is fairly common in the forests round Darjeeling.

E 3342. Darjeeling, 7000 ft. (Gamble).

6. POLYSCIAS, Forst. *P. acuminata*, Seem.; Fl. Br. Ind. ii. 727; Bedd. Fl. Sylv t. 213; Trimen Fl. Ceyl. ii. 282, is a small tree of the evergreen forests of the hill ranges of South India from the Nilgiris to Travancore at about 4–5000 ft., and of the banks of streams in the hill region of Ceylon.

7. HEPTAPLEURUM, Gaertn.

Twelve species of trees or climbing shrubs, mostly of South India or of the East Himalaya. *H. glaucum*, Bth. and Hook. f.; Fl. Br. Ind. ii. 728, is an evergreen tree of the Khasia Hills at 4–6000 ft., and *H. hypoleucum*, Kurz For. Fl. i. 539, a similar tree from the same region, also found in the drier hill forests of Burma, at 6000 ft. *H. rostratum*, Bedd. Fl. Sylv. cxxii., is a tree ("very large tree," Bedd.; "small branched tree," Clarke in Fl. Br. Ind.) of the Nilgiri and Anamalai Hills at 5–6000 ft. *H. racemosum*, Bedd. Fl. Sylv. t. 214; Fl. Br. Ind. ii. 729; Trimen Fl. Ceyl. ii. 283, is a large tree of the sholas of the Nilgiris and other hills of South India at 3–7000 ft., and of the hill ranges of Ceylon, with a soft grey wood. *H. Wallichianum*, Clarke; Fl. Br. Ind. ii. 730; Bedd. Fl. Sylv. cxxii.; Talbot Bomb. List 102 (*H. exaltatum*, Seem.; Trimen Fl. Ceyl. ii. 284), is also a large tree of the South Indian hills extending northwards to the Konkan Ghâts, and southwards to Travancore and the Ceylon Hills. *H. stellatum*, Gaertn. and *H. emarginatum*, Seem. are scandent shrubs of Ceylon, the former also of the South Indian Hills at rather low elevations. *H. Khasianum*, Clarke; Fl. Br. Ind. ii. 730, is a tree of the Khasia Hills at 3–6000 ft. and of the Mishmi and Bhutan Hills. *H. Lawranceanum*, Prain, is found in the Kachin Hills of Burma.

1. **H. impressum**, Clarke; Fl. Br. Ind. ii. 728; Gamble Darj. List 44. Vern. *Balu chinia*, Nep.; *Suntong*, Lepcha.

A large tree. *Bark* brown, thick, exuding a copious gum. *Wood* white, soft, even-grained. *Annual rings* marked by a white line. *Pores* very small, rather scanty, somewhat concentrically distributed. *Medullary rays* moderately broad, giving a pretty silver-grain.

Central and Eastern Himalaya from Kumaon to Bhutan at 6–10,000 ft., chiefly in the higher forests among the oaks and rhododendrons, as on the Tonglo Range.

	lbs.
E 3635. Goompahar Forest, Darjeeling, 7500 ft. (Gamble) . . .	37

2. **H. elatum**, Clarke; Fl. Br. Ind. ii. 728; Gamble Darj. List 44. *H. glaucum*, Kurz For. Fl. i. 538. Vern. *Chinia*, Nep.; *Prongzam*, Lepcha.

An evergreen tree. *Wood* white, soft, even-grained. *Pores* small, numerous. *Medullary rays* broad, with a few fine rays between, giving a good silver-grain.

Himalaya, from Kumaon to Bhutan at 5-7000 ft.; hill ranges of Burma at similar elevations.

E 3326. Rangirúm, Darjeeling, 6000 ft. (Gamble).
E 3417. Darjeeling, 6000 ft. (Gamble).

3. **H. venulosum,** Seem.; Fl. Br. Ind. ii. 729; Bedd. Fl. Sylv. cxxii.; Brandis For. Fl. 249; Kurz For. Fl. i. 538; Gamble Darj. List 44; Talbot Bomb. List 102. *Aralia digitata*, Roxb. Fl. Ind. ii. 107. Vern. *Dain*, Hind.; *Kat semul*, Dehra Dún; *Karboti semul*, Garhwal; *Kur semul*, Kumaon; *Singhata*, Nep.; *Sukriruin*, Kól; *Susurudi*, Khond; *Chippura*, Reddi; *Myaukletwa*, Yaw; *Baluletwa*, Burm.

A straggling or climbing shrub, often epiphytic. *Bark* grey, shining. *Wood* light brown, soft. *Pores* small, not very numerous. *Medullary rays* fine to moderately broad.

Common in the greater part of India from the Lower Himalaya and sub-Himalayan forests southwards and eastwards; all over Burma.

A common and rather handsome climber, more frequent on trees near villages and in open places than in forests, but not uncommon even there.

C 3442. Neturhát, Palamow, Chota Nagpore, 3000 ft. (Gamble).

8. TREVESIA, Vis. *T. palmata*, Vis.; Fl. Br. Ind. ii. 732; Kurz For. Fl. i. 539; Gamble Darj. List 44 (*Gastonia palmata*, Roxb. Fl. Ind. ii. 407); Vern. *Kajpati*, Nep.; *Suntong*, Lepcha; *Baw*, Burm., is an evergreen "treelet" or palm-like shrub of the forests of the lower sub-Himalaya from Nepal to Assam, Eastern Bengal and Burma, ascending to 5000 ft. It is found in forest undergrowth and has large palmate leaves and big fruit.

9. BRASSAIA, Endl. *B. capitata*, Clarke; Fl. Br. Ind. ii. 732, is a tree of the Nilgiri Hills, with digitate leaves, not at all common.

10. DENDROPANAX, Dcne. and Planch. *D. japonicum*, Seem.; Fl. Br. Ind. ii. 733, is a scarce shrub or small tree of the Khasia Hills at 4-5000 ft. *D. Listeri*, King in Journ. As. Soc. Beng. lxvii. ii. 294, is a large shrub of the Daphla Hills at 5-6000 ft.

11. ARTHROPHYLLUM, Blume. *A. diversifolium*, Blume; Fl. Br. Ind. ii. 733 (*A. javanicum*, Blume; Kurz For. Fl. i. 540), is an evergreen palm-like tree of the tropical forests of the West Coast of South Andaman.

12. HETEROPANAX, Seem.

1. **H. fragrans,** Seem.; Fl. Br. Ind. ii. 734; Brandis For. Fl. 249; Kurz For. Fl. i. 541; Gamble Darj. List 44. *Panax fragrans*, Roxb. Fl. Ind. ii. 76. Vern. *Tarla*, Dehra Dún; *Dimna*, Garhwal, Kumaon; *Lal totilla*, Nep.; *Siriokhtem*, Lepcha; *Kesseru*, Assam; *Hona*, Cachar; *Arengi banu*, Kól; *Tachanza, kyaungdauk*, Burm.

A small tree. *Bark* pale yellowish-grey, peeling off in thin flakes, ¼ in. thick. *Wood* grey, soft, porous. *Pores* moderate-sized, often subdivided, scanty. *Medullary rays* moderately broad, long but not deep, making a speckled silver-grain on a radial section. *Pith* large, round.

Sub-Himalayan tract and Siwalik Hills from the Jumna eastwards to Assam; Eastern Bengal; Chota Nagpore; deciduous forests throughout Burma; Andaman Islands.

A tree which has much the same appearance as *Oroxylum indicum*, but they can be at once distinguished when either in flower or fruit. It is a food-plant of the "Eri" silkworm of Assam (*Attacus Ricini*, Boisd.), whose usual food is the Castor-oil plant. The well-marked silver-grain would make the wood useful for articles of turnery. King (Journ. As. Soc. Beng. lxvii. ii. 405) speaks of this as becoming a tree 40 to 60 ft. high in the Andamans; I do not think I ever saw it so big in India.

	lbs.
O 4764. Phandowála, Dehra Dún, 2000 ft. (Gamble)	25

13. BRASSAIOPSIS, Dcne. and Plch.

Ten species, of the Eastern Himalaya, Eastern Bengal and Burma; usually erect small trees with the habit of palms. *B. Hainla*, Seem.; Fl. Br. Ind. ii. 735; Gamble Darj. List 44; Vern. *Tilhetter*, Nep.; *Suntong*, Lepcha, is a common small tree of the forests of the outer Sikkim Himalaya at 2-4000 ft. *B. palmata*, Kurz For. Fl. i. 537; Fl. Br. Ind. ii. 735 (*Panax palmatum*, Roxb. Fl. Ind. ii. 74), is an evergreen palm-like tree of the tropical forests of Chittagong and the Andamans. *B. alpina*, Clarke; Fl. Br. Ind. ii. 736, is a small tree of the higher hills of the Sikkim Himalaya at 10-11,000 ft.; and *B. hispida*, Seem.; Fl. Br. Ind. ii. 736; Gamble Darj. List 44; Vern. *Phota*, Nep.; *Suntong*, Lepcha, a small tree of the same hills at 6-7000 ft. *B. Hookeri*, Clarke; Fl. Br. Ind. ii. 737; Gamble Darj. List 44, also is a small tree of the Sikkim Himalaya and Khasia Hills at 2-5000 ft.; and *B. aculeata*, Seem.; Fl. Br. Ind. ii. 738, is a small prickly tree of the Khasia Hills, extending west to Nepal and Kumaon, but not recorded from Sikkim.

1. **B. mitis**, Clarke; Fl. Br. Ind. ii. 736; Gamble Darj. List 44. Vern. *Moqchini*, Nep.; *Suntong*, Lepcha.

A small tree. *Bark* thin, grey. *Wood* soft, white, spongy. *Pores* small, in groups and undulating lines. *Medullary rays* short, broad and very fine, marked in silver-grain as shining plates.

Sikkim Himalaya, above 5000 ft., common at Darjeeling.

Growth moderately fast, 5 rings per inch of radius. A handsome plant with broadly palmatifid leaves.

		lbs.
E 2382.	Rangbúl Forest, Darjeeling, 7000 ft. (Gamble)	24

2. **B. speciosa**, Dcne. and Planch.; Fl. Br. Ind. ii. 737; Gamble Darj. List 44.

A moderate-sized tree. *Bark* grey, thin. *Wood* white, in structure resembling that of *B. mitis*.

Eastern Himalaya from Nepal to Assam, rising to 5000 ft.; Eastern Bengal and Chittagong.

E 3409. Darjeeling, 6700 ft. (Gamble).

14. MACROPANAX, Miq.

Besides the species described, *M. oreophilum*, Miq.; Fl. Br. Ind. ii. 738; Kurz For. Fl. i. 541, is an evergreen tree of the forests of the Eastern Himalaya, Khasia and Martaban Hills above 5000 ft.

1. **M. undulatum**, Seem.; Fl. Br. Ind. ii. 738; Gamble Darj. List 44. Vern. *Chinia*, Nep.; *Prongzam*, Lepcha.

A moderate-sized evergreen tree. *Wood* soft, yellowish-white, even-grained. *Pores* small, numerous. *Medullary rays* broad, often with a few fine rays intervening, prominent on a radial section as a shining silver-grain. The distance between the rays is many times larger than the diameter of the pores, there being many lines of pores between each pair of rays.

Eastern Himalaya up to 5000 ft.; Assam, Khasia Hills and Sylhet.

		lbs.
E 688.	Chuttockpur Forest, Darjeeling, 6000 ft. (Johnston) . . .	30

15. HEDERA, Linn.

1. **H. Helix**, Linn.; Fl. Br. Ind. ii. 739; Brandis For. Fl. 248; Gamble Darj. List 44. The Ivy. *Lierre*, Fr.; *Epheu*, Germ.; *Ellera*, Ital. Vern. *Halbambar, arbambal*, Jhelum; *Karmora, mandia*, Kashmir; *Kurol*, Chenab; *Kuri, karúr*, Ravi; *Brúmbrúm, dakári*, Beas; *Karbaru, kaniúri, kadeoli*, Sutlej; *Mithiári*, Jaunsar; *Bánda, banu, malkanni*, Kumaon; *Dudela, singbana*, Nep.

A large woody climber. *Wood* white, soft, porous. *Annual rings* marked by a broad belt of pores and by less numerous pores in the autumn wood. *Pores* small, very numerous. *Medullary rays* short, moderately broad.

Himalaya from the Indus to Bhutan, between 2000 ft. in the Dehra Dún valley and 9000 ft. in the hills; Khasia Hills at 4–6000 ft.

The Ivy is very common in the Western Himalaya, getting gradually scarcer eastwards: in Sikkim I have only seen it in the Siri Valley below Sandukpho. The stems climb up trees by means of small extra-axillary rootlets, and often reach a large size, perhaps up to 1 ft. in diameter. In Europe it may get much larger. Mathieu mentions a plant near Montpellier 433 years old and having a trunk of over 10 ft. in girth. Growth slow, 22 rings per inch of radius. Weight: the specimens give 33 to 34 lbs.; Mathieu Fl. For. p. 202, gives 27 to 44 lbs.

		lbs.
H 69.	Mashobra, Simla, 7000 ft.	—
H 3010.	Kotgarh, Simla, 7500 ft. (Gamble)	34
H 4512.	Chachpúr Forest, Raiengarh, 9000 ft. (Gamble)	33
	Nordlinger's Sections, vol. 2.	

16. GAMBLEA, Clarke.

1. **G. ciliata,** Clarke; Fl. Br. Ind. ii. 740; Gamble Darj. List 44. Vern. *Rama,* Bhutia.

A good-sized tree. *Bark* grey, smooth. *Wood* white, shining, moderately hard. *Annual rings* well marked by a line of moderate-sized pores, *pores* in the rest of the wood very scanty, very small. *Medullary rays* fine and moderately broad, white, shining, irregularly distributed, with a speckled silver-grain. *Pith* round.

Eastern Himalaya in the forests of the Senchul and Singalila Ranges above 8000 ft. A fine tree, with a nice wood resembling ash.

		lbs.
E 3402.	Tonglo, Darjeeling, 9000 ft. (Gamble)	37

17. TUPIDANTHUS, Hook. f. and Th.

1. **T. calyptratus,** Hook. f. and Th.; Fl. Br. Ind. ii. 740.

A glabrous small tree, at first erect, afterwards a lofty climber. *Bark* light brown, very rough, granular. *Wood* grey, hard. *Pores* extremely small and very small, in small patches of loose tissue, more or less concentrically arranged. *Medullary rays* fine to moderately broad, scanty, silver-grain of dark plates.

Eastern Bengal; Khasia Hills at 2–3000 ft.
Moflong, Khasia Hills—Kew Museum (J. D. Hooker).

ORDER LVII. CORNACEÆ.

Seven genera, viz. Alangium, Marlea, Cornus, Mastixia, Aucuba, Nyssa, Torricellia, trees or shrubs chiefly Himalayan; but a few, such as *Alangium, Marlea* and *Mastixia,* extend to South India or Burma. Some of them give useful timbers, such as *Nyssa;* others give handsome woods likely to be valuable for turning, such as *Alangium* and *Aucuba.*

It is difficult to give general characters for the Order, but the *pores* are usually small and in short radial lines, and the *medullary rays* fine and numerous. But in *Aucuba* the rays are broad, and in *Torricellia* the pores are more or less in concentric bands.

1. ALANGIUM, Lamk.

Two species. *A. Kingianum*, Prain in Journ. As. Soc. Beng. lxvii. ii. 294, is a climbing shrub of the Kachin Hills of Burma.

1. A. Lamarckii, Thw.; Fl. Br. Ind. ii. 741; Bedd. Fl. Sylv. t. 215; Brandis For. Fl. 250; Talbot Bomb. List 103; Trimen Fl. Ceyl. ii. 285. *A. hexapetalum*, Roxb. Fl. Ind. ii. 502. *A. decapetalum*, Lamk. and *A. sundanum*, Miq.; Kurz For. Fl. i. 543. Vern. *Akol, akola, akhóra, ankora, akaul, ghowl, koeli, thaila*, Hind.; *Akshar*, Oudh; *Bismar*, Saharanpur; *Akar-kanta, bagh ankurá*, Beng.; *Dela*, Sonthal; *Kumri*, Mal Pahari; *Ankula, dolanku*, Uriya; *Akori*, Khond; *Wudaga*, Palkonda; *Wuruga*, Reddi; *Ankolamu, urgu, udagu*, Tel.; *Alangi*, Tam.; *Ankúl*, Mar.; *Asroli, ankola*, Kan.; *Uru*, Gondi; *Ankól*, Kól; *Arinjil*, Mal.; *Mul-anninchil*, Cingh.

A deciduous small tree, shrub or straggler. *Bark* ⅓ in. thick, grey, when young orange-yellow, fibrous. *Wood* hard, close- and even-grained, sapwood light yellow, heartwood olive-brown, with a pleasant scent. *Pores* small, scanty, in short radial lines of 2 to 5. *Medullary rays* fine, closely packed, wavy, bent round the pores, the diameter of which is slightly greater than the distance between the rays.

Throughout most of India in dry regions; in the sub-Himalayan tract from the Saharanpur Siwaliks eastwards to Nepal; Oudh, Bengal, Behar, Chota Nagpore; Orissa, Circars, Deccan and Carnatic; Western India in dry places down to Travancore; apparently scarce in Burma; tropical forests of the Andamans (*A. sundanum*, Miq.); dry regions of Ceylon, also moist region at 2–4000 ft. (*A. glandulosum*, Thw.).

A very variable plant, sometimes a climber, more usually a bushy shrub, exceptionally a small tree; most usually found in dry deciduous forests like those of the Deccan, or on fallow lands near villages. It has fragrant white flowers and an edible fruit. The growth is moderately slow, perhaps 5 rings per inch of radius. The wood is very good if found of large enough size, and would be useful for small articles, inlaying and carving. It seasons well, and cuts easily. It is used for pestles, oil-mills, wooden cattle-bells and other purposes, and is an excellent fuel. Skinner, No. 13, gives W = 49 lbs.; the specimens here mentioned give an average of 50 lbs. The root-bark is used in medicine.

		lbs.
C 3116.	Chanda, C.P. (Brandis)	56
C 3466.	Saranda Forests, Chota Nagpore (Gamble)	—
C 3564.	Khurdha Forests, Orissa (Gamble)	42
C 3951.	Rekapalle Forests, Godavari (Gamble)	—
D 4002.	Cuddapah Forests (Higgens)	52
D 1082.	North Arcot, Madras (Beddome)	49

2. MARLEA, Roxb.

About four species. *M. tomentosa*, Endl.; Kurz For. Fl. i. 545; Vern. *Ngapônse*, Burm., is a large evergreen tree of the tropical forests of Martaban, said by Kurz to have a pale brown, close-grained wood with a silvery lustre. In the Fl. Br. Ind. it is included under *M. begoniæfolia*, but seems from Kurz' description to be distinct. So, too, I consider *M. begoniæfolia*, var. *alpina*, Clarke, in Fl. Br. Ind. ii. 744; Vern. *Paletnyok*, Lepcha, which is a tree of the higher Sikkim Hills above 6000 ft. (I never saw the ordinary *M. begoniæfolia* at over 3000 ft.), with tomentose leaves *not* angled and large fruit, to be a distinct species. *M. barbata*, R. Br.; Fl. Br. Ind. ii. 743, is a small tree of the Bhutan and Khasia Hills and the Assam Valley.

1. M. begoniæfolia, Roxb. Fl. Ind. ii. 261; Fl. Br. Ind. ii. 743; Brandis For. Fl. 251; Kurz For. Fl. i. 544; Gamble Darj. List 45. Vern. *Garkum, budhal, túmbri*, N.-W. P.; *Bodara*, Beas; *Padlu*, Ravi; *Súlu*, Chenab; *Prot*, Kashmir; *Tilpattra, chitpattra, kurkui*, Jhelum; *Bhutkainju*, Jaunsar; *Garh kimu*, Dehra Dún; *Tumri*, Kumaon; *Timil*, Nep.; *Palet*, Lepcha; *Tabuya*, Burm.; *Marlea, marliza*, Sylhet.

A small tree. *Bark* smooth, thin, grey. *Wood* white, soft, even-grained. *Annual rings* marked by a belt of numerous pores. *Pores*

moderate-sized and large, small in the outer portion of each ring. *Medullary rays* short, wavy, fine and moderately broad, prominent in the silver-grain.

Outer Himalaya from the Indus to Bhutan, ascending to 6000 ft.; Khasia Hills, Eastern Bengal, Chittagong, Shan Hills, Kachin Hills and Martaban.

The wood is used in Sylhet for native houses (Roxb.). The leaves are sometimes used for fodder for cattle. Growth moderately fast, 5 rings per inch of radius.

		lbs.
H 2831.	The Glen, Simla, 6000 ft. (Gamble)	42

3. CORNUS, Linn.

Four species.

Wood light brownish or pinkish-white, moderately hard, even-grained. *Pores* small, evenly distributed. *Medullary rays* moderately broad to fine, often short.

1. C. sanguinea, Linn.; Fl. Br. Ind. ii. 744; Brandis For. Fl. 253. Dogwood. *Cornouiller sanguin*, Fr.

An erect shrub. *Wood* very pale brown, even-grained. *Annual rings* marked by a continuous belt of pores, the part of the autumn ring behind it without pores; in the rest of the wood the *pores* are small, evenly distributed. *Medullary rays* moderately broad, very short, rather scanty.

Kashmir: only once found, viz. by Dr. J. L. Stewart at Gulmurg, 7000 ft. Common in Europe on calcareous soils.

Mathieu Fl. For. 205 gives the weight at 54 to 56 lbs.

Nordlinger's Sections, vol. 1.

2. C. macrophylla, Wall.; Fl. Br. Ind. ii. 744; Brandis For. Fl. 252, t. 32; Gamble Darj. List 45. Vern. *Kasír, kachír, haleo, allian, haddú, harru, nang, kandara, kaksh, kachúr, kochan, kágsha, rúchia*, Hind.; *Kanchinu, shka*, Sutlej; *Kagsha*, Jaunsar; *Kalshi, khaksho*, Kumaon; *Chilania*, Dotiál; *Patmoro*, Nep.

A small tree. *Bark* rough, brown, splitting into small squares. *Wood* pinkish-white, moderately hard, even-grained, warps badly and has an unpleasant scent. *Annual rings* marked by a narrow line without pores, on the outer edge of each ring. *Pores* small, numerous, evenly distributed. *Medullary rays* short, moderately broad, with fewer fine rays, giving the wood on a radial section a mottled silver-grain.

Himalaya from the Indus to Bhutan, from 3–8000 ft.

Growth moderate, 8 to 9 rings per inch of radius (Brandis); the specimens show 15 rings. The wood gives good gunpowder charcoal, according to Brandis. The fruit is eaten, and the leaves given as fodder to goats.

		lbs.
H 84.	The Glen, Simla, 6000 ft.	45
H 924.	Hazara, Punjab, 6000 ft. (Baden-Powell)	43

3. C. oblonga, Wall.; Fl. Br. Ind. ii. 744; Brandis For. Fl. 253; Kurz For. Fl. i. 545. Vern. *Kagshi*, Sutlej; *Dab*, Kunawar; *Kasmol, bakár, ban-bakár, halá*, Hind.; *Korhoi*, Jaunsar; *Baumri*, Kumaon; *Katkanai*, Garhwal; *Titmolia*, Dotiál.

A small tree. *Bark* reddish-brown, rough. *Wood* pinkish-white, moderately hard, even-grained, has an unpleasant scent. *Annual rings* marked by a belt without pores at the outer edge of each ring, elsewhere *pores* small, numerous. *Medullary rays* numerous fine, with a few slightly broader ones.

Outer Himalaya from the Indus to Bhutan, at 3–6000 ft.; Martaban Hills in Burma, at 4–7000 ft. (Kurz).

Growth moderate, 10 rings per inch of radius.

		lbs.
H 150.	Sainj, Giri Valley, 4000 ft.	46
H 3094.	Tarwa Forest, Julung, Simla, 4000 ft.	50

4. **C. capitata,** Wall.; Fl. Br. Ind. ii. 744; Brandis For. Fl. 253; Gamble Darj. List 45. *Benthamia fragifera*, Lindley. Vern. *Thammal, tharbal, tharwar, thesi, bamaur, bamora*, Hind.; *Thanboi*, Jaunsar; *Tumbúk*, Lepcha.

A small deciduous tree. *Bark* thin, greyish-brown. *Wood* pinkish-white, with rather darker heartwood, warps in seasoning, moderately hard, close-grained. *Annual rings* marked by a belt without pores, elsewhere *pores* very small, scanty. *Medullary rays* numerous, fine, short.

Himalaya from the Beas to Bhutan, between 3500 and 8000 ft.; Khasia Hills.

Growth slow, 10 to 16 rings per inch of radius. Weight 45 to 50 lbs. per cubic foot. The wood is used only for firewood. This is probably the *Cornus, sp.*, of whose wood 5 maunds were sent to the Ishapore Gunpowder Agency in 1865 (Bengal Forest Report, 1865–66, page 2), of the result of which experiment we have no record. The fruit is red, strawberry-like, and is eaten and made into preserves. The tree is very handsome when in flower, with its large cream-coloured involucre.

		lbs.
H 78.	Mashobra, Simla, 7000 ft.	—
H 94.	Simla, 6000 ft.	45
H 4771.	Deota, Tehri-Garhwal, 8000 ft. (Gamble)	50
E 3640.	Phallaloong Forest, Darjeeling, 8000 ft. (Gamble)	—
	Nordlinger's Sections, vol. 8.	

4. MASTIXIA, Blume.

Four species. *M. tetrandra*, Clarke; Fl. Br. Ind. ii. 745; Trimen Fl. Ceyl. ii. 287, t. 47; Vern. *Mahatawara, diya-taleya* (var. *Thwaitesii*, Clarke), Cingh., is a large tree with smooth bark and red heavy wood, endemic in the moist region of Ceylon up to 4000 ft. *M. euonymoides*, Prain in Journ. As. Soc. Beng. lxvii. ii. 295, is a tree of the Kachin Hills of Burma.

1. **M. arborea,** Clarke; Fl. Br. Ind. ii. 745; Bedd. Fl. Sylv. t. 216; Trimen Fl. Ceyl. ii. 287.

A large tree. *Wood* greenish-grey, soft. *Pores* small, numerous, evenly distributed. *Medullary rays* fine and very fine, numerous, short. *Annual rings* indistinct.

Cachar, the Nilgiri Hills and other Hills of S. India to Travancore; Ceylon at 4–7000 ft.

Bourdillon gives W = 32 lbs., P = 452.

		lbs.
W 4711.	Travancore (Bourdillon)	30

2. **M. pentandra,** Blume; Fl. Br. Ind. ii. 746; Talbot Bomb. List 103.

A tree. *Wood* white, soft, shining. *Pores* small or moderate-sized, evenly distributed. *Medullary rays* fine, numerous.

Forests of Western India, in the Konkan and N. Kanara and down to Travancore, also in Dharwar and Bellary.

Bourdillon gives W = 28 lbs., P = 331.

		lbs.
W 4596.	Travancore (Bourdillon)	27

5. AUCUBA, Thunb.

Contains one large shrub or small tree of the Eastern Himalaya. *A. japonica*, Thunb. is a well-known shrub of English gardens, recognized by its shining leaves, blotched with yellow.

1. **A. himalaica,** Hook. f. Ill. Him. Pl. t. 12; Fl. Br. Ind. ii. 747; Brandis For. Fl. 254; Gamble Darj. List 45. Vern. *Phul amphi,* Nep.; *Singna, tapathyer,* Lepcha.

A small evergreen tree. *Bark* thin, smooth, dark grey. *Wood* black when fresh cut, becoming dark brownish-grey, hard and close-grained. *Pores* extremely small, scanty, in distant radial strings. *Medullary rays* of two classes, numerous fine rays between fewer broad or very broad ones, these being visible in the silver-grain as irregular plates and streaks.

Sikkim Himalaya between 5000 and 9000 ft.; Manipur at 4–10,000 ft. (Watt).

An evergreen shrub or small tree of the undergrowth of the upper hill forests.

The wood has a good silver-grain, and would be useful for inlaying and small carvings. Growth slow, 20 rings per inch of radius (Gamble); one specimen, E 3327, shows 10 rings.

		lbs.
E 2383.	Rangbúl Forest, Darjeeling, 7000 ft. (Gamble)	55
E 3327.	Rangirúm „ „ 6000 ft. „	—

6. NYSSA, Linn.

1. **N. sessiliflora,** Hook. f.; Fl. Br. Ind. ii. 747; Gamble Darj. List 45. *Daphniphyllopsis capitata,* Kurz For. Fl. i. 240. *Ilex daphniphylloides,* Kurz; Fl. Br. Ind. i. 606. Vern. *Kalay, chilauni,* Nep.; *Tumbrúng,* Lepcha.

A large evergreen tree. *Wood* grey, soft, even-grained. *Pores* small, often subdivided or in short radial lines, between the fine and very numerous, straight but short *medullary rays.*

Eastern Himalaya in Sikkim and Bhutan above 5000 ft., common in the forests of Senchal and Mahalderam and at Dumsong; damp hill forests of Martaban at 4–6000 ft.

One of the building timbers of the Darjeeling Hills, in considerable use. It occasionally reaches a height of 100 to 120 ft.

		lbs.
E 695.	Chuttockpur Forest, Darjeeling, 6000 ft. (Johnston)	39
E 3608.	Darjeeling Forests, 6000 ft. (Gamble)	—

Nordlinger's Sections, vol. 10 (*Daphniphyllopsis capitata*) (Tab. VIII. 6).

7. TORRICELLIA, DC.

1. **T. tiliæfolia,** DC; Fl. Br. Ind. ii. 748; Gamble Darj. List 45. Vern. *Bhelu, kondlo,* Ass.

A small tree ("immense tree," Peal). *Bark* ashy-grey, thin, granulated. *Wood* white, even-grained, moderately hard. *Annual rings* marked by a line of moderate-sized, closely and regularly packed pores; in the rest of the wood the *pores* are small, and arranged in regular, somewhat concentric, wavy bands. *Medullary rays* fine to moderately broad, evenly distributed, showing a silver-grain.

East Himalaya from Nepal to Bhutan at 7–10,000 ft.; Khasia Hills and Assam.

This is only a small tree in the Darjeeling Hills, but S. E. Peal says it grows to an immense size in Assam, 60 or 70 ft. to first branch, and up to 20 ft. in girth. He says the wood is good for tea-boxes, and that a large tree would give 100 to 120 boxes.

E 3721. Goompahar, Darjeeling, 7500 ft. (Gamble).

Series IV. GAMOPETALÆ.

Order LVIII. CAPRIFOLIACEÆ.

Contains six genera belonging to the two following Tribes :—

Tribe I. Sambuceæ . . . . Sambucus, Viburnum.
„ II. Loniceræ . . . . Abelia, Lonicera, Leycesteria, Pentapyxis.

With very few exceptions, the species are all from the higher hill regions, chiefly Himalayan, and few of them are more than large shrubs or small trees of very little economic or sylvicultural forest interest.

Wood close-grained. *Pores* very small or extremely small, uniformly distributed. *Medullary rays* fine to extremely fine, numerous.

1. SAMBUCUS, Linn.

Contains three Indian species. *S. Ebulus*, Linn.; Fl. Br. Ind. iii. 2; Brandis For. Fl. 260; the Dwarf Elder; Vern. *Richh kas, mushkiára, ganhúla*, Jhelum; *Gandal, gwandish, siske tásar*, Chenab, is a herbaceous plant from a perennial root stock, found in the valleys of the Jhelum and Upper Chenab. *S. adnata*, Wall.; Fl. Br. Ind. iii. 3; Brandis For. Fl. 576; Gamble Darj. List 45; Vern. *Chiriyabang*, Nep., is an undershrub of Nepal and Sikkim found at 6–11,000 ft.

1. S. javanica, Blume; Fl. Br. Ind. iii. 2; Gamble Darj. List 45. *S. Thunbergiana*, Bl.; Kurz For. Fl. ii. 3. The Himalayan Elder. Vern. *Galeni*, Nep.

A small tree. *Bark* light brown, rather corky. *Wood* white to light brown, soft. *Annual rings* marked by a circle of moderate-sized pores; in rest of wood *pores* small, scanty, often subdivided. *Medullary rays* distant, fine to broad. *Pith* large, about ½ in. in diameter.

Eastern Himalaya at 4–8000 ft., Khasia Hills; hills of Upper Burma. Chiefly found in second-growth forest.

E 3133. Mangwa Forest, Darjeeling, 5000 ft. (Gamble).

2. VIBURNUM, Linn.

About 17 species, shrubs or small trees, chiefly Himalayan, but some found in the Khasia Hills, and a few in the hills of South India and Ceylon. *V. corylifolium*, Hook. f. and Th.; *V. odoratissimum*, Ker; and *V. Simonsii*, Hook. f. and Th., are all shrubs of the Khasia Hills at 4–6000 ft.; while *V. atro-cyaneum*, Clarke, occurs in the Mishmi Hills, and *V. Griffithianum*, Clarke, in the Naga Hills of Assam. *V. fœtidum*, Wall.; Fl. Br. Ind. iii. 4; Kurz For. Fl. ii. 2, is a large shrub of Assam, the Khasia Hills and the Shan Hills of Burma at 3–5000 ft. *V. punctatum*, Ham.; Fl. Br. Ind. iii. 5; Brandis For. Fl. 260; Gamble Darj. List 45; Vern. *Gaunta*, Kumaon, is a large shrub of the Central Himalaya from Kumaon to Sikkim at 3–5000 ft. *V. cordifolium*, Wall.; Fl. Br. Ind. iii. 9; Gamble Darj. List 46, is a small tree of the Central and Eastern Himalaya from Kumaon to Bhutan at high elevations, 9–12,000 ft.

The Guelder Rose, cultivated in gardens in Europe, is *V. Opulus*, Linn., and the Laurustinus is *V. Tinus*, Linn., indigenous in the Mediterranean region.

Bark thin. *Wood* usually hard (that of *V. Colebrookianum*, a plains species, is soft), close-grained. *Pores* small, numerous. *Medullary rays* fine, numerous, usually short., Medullary patches in most species.

1. V. cotinifolium, Don; Fl. Br. Ind. iii. 3; Brandis For. Fl. 258. Vern. *Mar ghwalawa*, Trans-Indus; *Rich úklu, bankúnch*, Jhelum; *Richabi, kilmich, gúch*, Kashmir; *Bathor, pápat kalam, khímor, rájal, túmma*, Chenab; *Kátonda*, Ravi; *Jawa*,

khateb, tústús, sússú, Sutlej; *Bhatnoi,* Jaunsar; *Peralu,* Byáns; *Gwia, gúya, gúi,* Kumaon; *Bansura, guwa, gendu, titmoya,* Garhwal.

A large deciduous shrub. *Bark* greyish-brown, $\frac{1}{8}$ in. thick. *Wood* white, hard, close-grained. *Pores* very small, scanty, uniformly distributed. *Medullary rays* fine and very fine, short, extremely numerous. Medullary patches brown, frequent.

West Himalaya from Kashmir to Kumaon at 4–11,000 ft.; Suliman Range; Eastern Bhutan.

A common shrub in the higher hill forests of oak and deodar, affecting open places on the rather drier exposures. It much resembles the European *V. Lantana,* Linn., and has black edible fruit.

H 52, 2869. Nagkanda, Simla, 8000 ft. (Gamble).
H 76. Mashobra, Simla, 7000 ft.
Nordlinger's Sections, vol. 9.

2. **V. stellulatum,** Wall.; Fl. Br. Ind. iii. 4; Gamble Darj. List 45. *V. Mullaha,* Brandis For. Fl. 258, 576. Vern. *Jal bágú,* Jhelum; *Amliácha, phulsel,* Kashmir; *Lal titmaliya, titmoya,* Kumaon; *Titmolia, maleo,* Garhwal; *Ensi,* Sutlej; *Richhoi,* Jaunsar; *Eri, ira,* Simla; *Gorakuri,* Nep.

A shrub. *Bark* dark grey, reticulate. *Wood* white, moderately hard; structure the same as that of *V. cotinifolium.*

Himalaya, from Kashmir to Bhutan at 6–11,000 ft.

A common shrub in the West Himalaya, especially in moist localities in the underwood of forests of oak and fir. Fruit bright red, edible.

H 2834. The Glen, Simla, 6000 ft. (Gamble).
H 2866. Nagkanda „ 8000 „

3. **V. Colebrookianum,** Wall.; Fl. Br. Ind. iii. 5; Gamble Darj. List 45. *V. lutescens,* Hook. f. and Th.; Kurz For. Fl. ii. 3.

A large shrub. *Bark* greyish-brown, thin. *Wood* reddish, soft. *Pores* moderate-sized, very numerous. *Medullary rays* fine, very numerous. *Annual rings* not visible.

Terai and Lower Hills of Sikkim; Assam, Khasia Hills, Upper Burma: in damp evergreen forests.

E 3273. Múraghát Reserve, W. Dúars (Gamble).

4. **V. acuminatum,** DC. *V. punctatum,* Ham. var. *acuminata,* Wall.; Fl. Br. Ind. iii. 5. *V. punctatum,* Ham.; Bedd. Fl. Sylv. t. 217; Talbot Bomb. List 103. Vern. *Yellé sundé,* Badaga.

A small evergreen tree. *Bark* brown, thin, tessellated in small elongated diamonds. *Wood* light red, hard, close-grained. *Pores* very small, very numerous, uniformly distributed. *Medullary rays* very fine, very numerous.

Mahendragiri Hill, in N. Circars, at 4000 ft.; Bababuden Hills in Mysore; sholas of the Nilgiris above 6000 ft.

W 3739. Coonoor, Nilgiris, 6000 ft. (Gamble).

5. **V. coriaceum,** Bl.; Fl. Br. Ind. iii. 5; Brandis For. Fl. 259; Gamble Darj. List 46. Vern. *Kala titmaliya,* Kumaon; *Rashnia,* Jaunsar; *Titmolia, karwi,* Garhwal; *Bara gorakuri,* Nep.

A large shrub or small tree. *Bark* greyish-brown, rather corky. *Wood* similar to that of *V. cotinifolium,* but the *pores* larger and the *medullary rays* slightly broader.

Himalaya from the Sutlej to Bhutan at 4–8000 ft.; Khasia Hills; hills of Ceylon.

Frequent in the West Himalaya in rather dry forests, chiefly with "Ban" oak and rhododendron.

The Nepalese are said to extract from the seeds an oil which they use for food and for burning.

		lbs.
H 2835.	The Glen, Simla, 6000 ft. (Gamble)	50
E 3332.	Darjeeling Forests „ „	—

6. V. hebanthum, W. and A.; Fl. Br. Ind. iii. 6; Bedd. Fl. Sylv. cxxiv. Vern. *Kadambu*, Badaga.

A small tree. *Bark* brown, thin, with small round lighter-coloured lenticels. *Wood* light reddish-brown, moderately hard. *Pores* small, numerous, uniformly distributed between the numerous fine *medullary rays*. Apparently no medullary patches.

Shola forests of the Nilgiri Hills, Pulney Hills, etc., at 5–8000 ft.

This is a common tree in the Nilgiri sholas, conspicuous by its bright green foliage and strong heavy unpleasant odour.

		lbs.
W 3775, 3904.	Ootacamund, Nilgiris, 7000 ft. (Gamble) . .	40

7. V. erubescens, Wall.; Fl. Br. Ind. iii. 7; Bedd. Fl. Sylv. cxxiv.; Brandis For. Fl. 258; Gamble Darj. List 46; Trimen Fl. Ceyl. ii. 289. Vern. *Ganné, avari*, Nep.; *Kancha*, Lepcha; *Damshing, nakouli*, Bhutia.

A small tree. *Bark* thin, grey. *Wood* soft to hard, reddish, close- and even-grained. *Pores* very small. *Medullary rays* undulating, fine and very fine, very numerous. No medullary patches.

Himalaya from Kumaon to Bhutan, at 5–11,000 ft.; Nilgiris and Ceylon.

A common tree in second-growth forest about Darjeeling, and conspicuous on account of its beauty when in flower. The wood of the Nilgiri plants is softer and lighter than that of Himalayan ones. The Himalayan wood might do as a substitute for boxwood and for carving. It is used for house-posts in Sikkim. The tree grows well and quickly from cuttings.

		lbs.
E 2384.	Rangbúl, Darjeeling, 7000 ft. (Gamble)	59
W 4042.	Lovedale, Ootacamund „ „	34

8. V. nervosum, Don; Fl. Br. Ind. iii. 8; Brandis For. Fl. 259; Gamble Darj. List 46. Vern. *Ambre, amrola, ári*, Ravi; *Rís, dáb*, Beas; *Tirnoi*, Jaunsar.

A small deciduous tree or large shrub. *Bark* $\frac{1}{4}$ in. thick, dark brownish-grey, in small rounded tessellated flakes. *Wood* pinkish-white, hard, close-grained. *Pores* very small, uniformly distributed. *Medullary rays* fine, rather scanty, reddish. Many medullary patches.

Himalaya, from Kashmir to Sikkim, at 9–13,000 ft.

A high-level tree, flowering before the leaves appear, flower corymbs pinkish-white, graceful; it grows chiefly among the "Kharshu" oak, and with the lilac rhododendron.

		lbs.
H 4768.	Balcha, Tehri-Garhwal, 9000 ft. (Gamble)	54

9. V. fœtens, Dcne.; Fl. Br. Ind. iii. 8; Brandis For. Fl. 259. Vern. *Gúch, úklu, kúnch*, Jhelum; *Kilmich, gúch, kwillim, kulára, jamára*, Kashmir; *Tilhanj, púlmu, tiláto, túin*, Chenab; *Talhang, tandei, túndhe, tunáni zenáni*, Ravi; *Talhang thelain, tselain, thilkain*, Sutlej; *Tirnoi*, Jaunsar; *Gúya*, Kumaon.

A large deciduous shrub. *Bark* grey. *Wood* white, hard, close-grained, similar in appearance and structure to that of *V. nervosum*.

West Himalaya, at 5–11,000 ft.

Also found in high-level forests, and greatly resembling *V. nervosum*, but distinguished from it by having more distant leaf-nerves, a large fruit and a strong unpleasant smell. It also affects forests of the "Móru" and "Kharshu" oak. The fruit is edible.

		lbs.
H 53.	Nagkanda, Simla, 8000 ft.	53
H 2886.	" " " (Gamble)	—
H 3015.	Matiyána " " "	—
E 975.	Chumbi Valley, Tibet, 10,000 ft. (Schlich)	—

3. ABELIA, Brown.

1. **A. triflora**, Br.; Fl. Br. Ind. iii. 9; Brandis For. Fl. 257. Vern. *Khirmich*, Kashmir; *Adei, paktawar*, Trans-Indus; *Cheta búta*, Jhelum; *Ban bakharu, salanker*, Chenab; *Dalúng, kút sái*, Ravi; *Zbang, matzbang, peni*, Sutlej; *Mali*, Jaunsar; *Munri, gogatti, kumki, danton*, Kumaon; *Bhartula*, Garhwal.

A large shrub. *Bark* grey, thin, fibrous, with long regular vertical fissures. *Wood* greyish-white, hard, close- and even-grained. *Pores* extremely small, scanty, except those at the edge of each annual ring, which are small and continuous. *Medullary rays* very numerous, varying from very fine to moderately broad. *Pith* large, round.

Safedkoh and Suliman Range; Western Himalaya at 4–10,000 ft.

An ornamental shrub with a nice wood, chiefly found on limestone ridges. It is one of the plants which grow in company with *Indigofera heterantha*, and are useful as nurses for deodar seedlings.

		lbs.
H 2937.	Naldehra, Simla, 7500 ft. (Gamble)	65
H 4403.	Mandáli, Jaunsar, 5000 ft. "	64

4. LONICERA, Linn.

A large genus containing some 28 species, many of which are, however, small shrubs or climbers of very slight interest from a forest point of view, and growing for the most part in very high regions in the Himalaya. The genus has two well-marked sub-genera—CAPRIFOLIUM with climbing species, and XYLOSTEUM with erect ones.

In CAPRIFOLIUM there are about nine species. *L. Leschenaultii*, Wall. is the common kind of the South Indian Hills; *L. glabrata*, Wall. is the common one about Darjeeling; while *L. macrantha*, DC and *L. acuminata*, Wall. are also Sikkim species, rather less common, both extending to the Khasia Hills, and the former to Upper Burma. *L. ovata*, Ham. is found in Assam. *L. Braceana*, Hemsl. in Journ. Linn. Soc. xxviii. 64 (footnote), is a fine species of the Khasia Hills, first discovered (I believe) by Sir D. Brandis in 1879, with a corolla about 4 in. long; but even this is outstripped by *L. Hildebrandiana*, Coll. and Hemsl. in Jour. Linn. Soc. xxviii. 64, t. xi.; Hook. f. Bot. Mag. t. 7677, which is a tall glabrous climbing shrub of the Shan Hills at 5000 ft. (Collett) and Manipur (Watt) with a corolla 7 in. long. The flowers are used to decorate temples. *L. leiantha*, Kurz, and *L. obscura*, Coll. and Hemsl., are also climbing shrubs of Upper Burma and the Shan Hills. This is the sub-genus to which the European Honeysuckle, much cultivated in hill gardens, *L. Periclymenum*, Linn., belongs.

In sub-genus XYLOSTEUM there are about 18 to 20 species, six of which, the largest and most important, are here described. The rest are small shrubs of the higher ranges of the Himalaya, and are of very little consequence. The most noticeable is perhaps *L. purpurascens*, Hook. f. and Th., met with among the "Kharshu" oak, yew, white birch and lilac rhododendron at about 10–12,000 ft. in the Western Himalaya.

Wood of the shrubby kinds hard, close-grained, often prettily coloured. *Pores* in the annual rings usually moderately broad, in the rest of the wood very small. *Medullary rays* short, fine, numerous. In *L. ligustrina* the pores are all of the same size. In the climbing section the pores are large and the wood porous and soft.

1. **L. Leschenaultii**, Wall.; Fl. Br. Ind. iii. 10.

A climbing shrub. *Bark* light brown, thick, peeling off in long, thin papery fibrous flakes. *Wood* white, soft, porous. *Pores* large,

evenly distributed. *Medullary rays* very fine, very numerous, indistinct.

Hills of South India, at 5–8000 ft., common on the Nilgiris.

W 4148. Fairlawns, Ootacamund, 7000 ft. (Gamble).

2. **L. glabrata,** Wall.; Fl. Br. Ind. iii. 10; Gamble Darj. List 46. Vern. *Bet-lara*, Nep.

A climbing shrub. *Bark* brown. *Wood* brown, soft, porous, in structure the same as *L. Leschenaultii.*

Eastern Himalaya, from Nepal to Bhutan, at 4–8000 ft., common about Darjeeling.

E 2863. Tukdah Forest, Darjeeling, 6000 ft. (Gamble).

3. **L. ligustrina,** Wall.; Fl. Br. Ind. iii. 12; Bedd. Fl. Sylv. cxxiv.

A shrub, with spirally twisted fluted stem. *Bark* light brown, thin, peeling off in papery strips. *Wood* white, hard, close- and even-grained. *Pores* very small, more numerous in the inner edge of the annual rings which they mark. *Medullary rays* extremely fine, numerous.

Khasia Hills, at 4–6000 ft.; hills of South India above 6000 ft., very common on the Nilgiris, and occasionally used for hedges.

		lbs.
W 3800, 4034.	Fairlawns, Ootacamund, 7000 ft. (Gamble) . . .	51

4. **L. angustifolia,** Wall.; Fl. Br. Ind. iii. 13; Brandis For. Fl. 255. Vern. *Geang, banchilu, pirlu,* Jaunsar; *Piler, kanching, zashé, chilru, pilru, philku,* Sutlej.

A small shrub. *Bark* smooth, grey, exfoliating in broad flakes. *Wood* white, very close-grained. *Annual rings* marked by a line of small pores; *pores* in the rest of the layer gradually decreasing in size, scanty. *Medullary rays* very fine, short, numerous.

Himalaya from the Indus to Sikkim, at 6–10,000 ft.

A very common shrub in the underwood of the upper forests of oak and fir and deodar, with red edible berries. The beautiful Cantharid beetle, *Cantharis antennalis,* Maiseul, is frequently to be found on its leaves in June in the Jaunsar Hills.

		lbs.
H 2843.	Mahasu, Simla, 8500 ft. (Gamble)	60
H 2875.	Nagkanda, Simla, 8000 ft. „	—
H 4789.	Thunwara Forest, Tehri-Garhwal, 7500 ft. (Gamble) . .	47
	Nordlinger's Sections, vol. 8.	

5. **L. quinquelocularis,** Hardw.; Fl. Br. Ind. iii. 14; Roxb. Fl. Ind. i. 537; Brandis For. Fl. 255. Vern. *Jarlangei, adei,* Trans-Indus; *Phút,* Jhelum; *Tita bateri, pákhur,* Kashmir; *Bakhru,* Chenab; *Khúm, sái,* Ravi; *Dendra,* Beas; *Kliunti, kraunti, takla, zbang, razbam, bhajra, bhijaul, bijgai,* Sutlej; *Taknoi,* Jaunsar; *Bet kukri, bhat kukra, dayáro, cheraya, kurmali,* Kumaon; *Panipatia,* Dotiál.

A large deciduous shrub or small tree. *Bark* thin, grey, with longitudinal fissures, peeling off in long papery shreds. *Wood* hard, close-grained: sapwood white, heartwood greyish-brown or yellowish-brown, with darker streaks. *Annual rings* marked by a narrow continuous belt of small pores; in the remainder of the ring the *pores* are extremely small. *Medullary rays* short, fine, numerous.

Baluchistan, Suliman Range and Safedkoh; Himalaya from Kashmir to Nepal at 6–10,000 ft.

A common and conspicuous plant in the forests of the Western Himalaya, preferring rather dry aspects and open hill-sides. The wood is handsome, and might be used for turning and carving. The leaves and branches are eaten by cattle. As is the case

with the preceding species, the beautiful Cantharid beetle, *Cantharus antennalis*, Maiseul, may be found on its leaves in the Jaunsar forests in June.

		lbs.
H 81.	Mashobra, Simla, 7000 ft.	—
H 2874.	Nagkanda „ 8000 ft. (Gamble)	52
H 3180.	Dungagalli, Hazara, 7000 ft. (Wild)	—
H 4421.	Jaunsar Forests, 7000 ft. (Gamble)	61
H 4778.	Deota Forests, Tehri-Garhwal, 9000 ft. (Gamble)	54
P 4471.	Baluchistan Forests (Lace)	62

Nordlinger's Sections, vol. 8 (Tab. IX. 1).

6. **L. hypoleuca,** Dcne.; Fl. Br. Ind. iii. 14; Brandis For. Fl. 256. Vern. *Kharmo, kodi,* Chenab; *Zhiko, rapesho, kakshoz, kusho,* Sutlej.

A shrub. *Bark* smooth, grey, peeling off in papery flakes. *Wood* white, darker in the centre, moderately hard, close-grained. *Pores* in the annual rings small, in a continuous belt; in the rest of the wood very small. *Medullary rays* fine, numerous.

Hills of Baluchistan; West Himalaya from Kashmir to Kumaon, at 8–10,000 ft.

P 4472. Baluchistan Forests (Lace).
Nordlinger's Sections, vol. 5.

7. **L. orientalis,** Lam.; Fl. Br. Ind. iii. 15; Brandis For. Fl. 256; Vern. *Taknoi,* Jaunsar.

A large shrub. *Bark* peeling off in thin flakes. *Wood* white, with a darker centre, moderately hard. *Pores* in the annual ring moderate-sized; in the rest of the wood extremely small. *Medullary rays* short, fine, numerous.

West Himalaya, from Kashmir to Kumaon, at 8–10,000 ft.

A shrub of damp places in the hill forests, as in ravines and on shady aspects.

H 2909. Nagkanda, Simla, 8000 ft. (Gamble).
H 3017. Hattu, Simla, 10,000 ft. „

8. **L. alpigena,** Linn.; Fl. Br. Ind. iii. 15; Brandis For. Fl. 256.

A shrub. *Bark* grey-brown, peeling off in irregular papery flakes. *Wood* moderately hard, white. *Pores* in the annual rings moderate-sized; in the rest of the wood extremely fine. *Medullary rays* fine, numerous.

West Himalaya from Kashmir to Kumaon, at 8–10,000 ft.

H 2912. Nagkanda, Simla, 8000 ft. (Gamble).
H 3016. Hattu, Simla, 10,000 ft.

5. LEYCESTERIA, Wall.

Two species. *L. glaucophylla,* Hook. f. is a small shrub of the Sikkim Himalaya at 5–6000 ft.

1. **L. formosa,** Wall.; Fl. Br. Ind. iii. 16; Brandis For. Fl. 256; Gamble For. Fl. 46. Vern. *Bhujnali,* Jaunsar; *Malkarr, dúni, saunjla, nalkaru, karnaliya,* Kumaon; *Danda bhekar,* Garhwal; *Tunguk,* Lepcha.

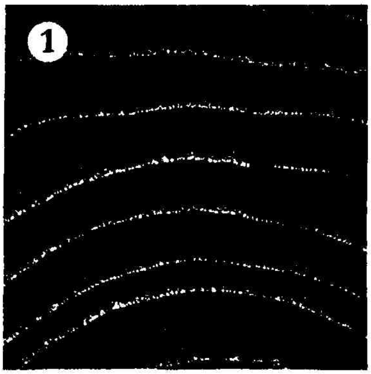
An erect shrub with hollow, generally herbaceous, stems. *Bark* grey, shining. *Wood* resembling in structure that of *Lonicera,* but with slightly broader medullary rays.

Throughout the Himalaya from the Sutlej to Bhutan, at 5–10,000 ft.; Khasia Hills at 5–6000 ft.

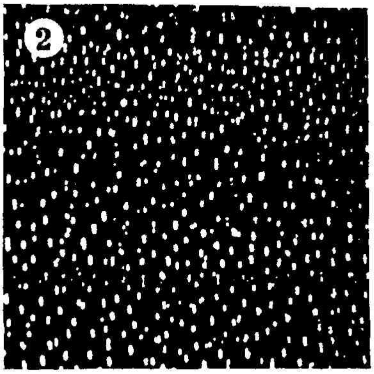
A small and common shrub of the undergrowth in the hill forests, under oak and fir in the West Himalaya; and under oak and chestnut, etc., and in second-growth forest in the Sikkim Himalaya. It is cultivated in Europe, in gardens. The hollow stems are made into whistles and flutes by Jaunsari shepherd-boys (U. N. Kanjilal).

H 2849. Mahasu, Simla, 8000 ft. (Gamble).

IX.

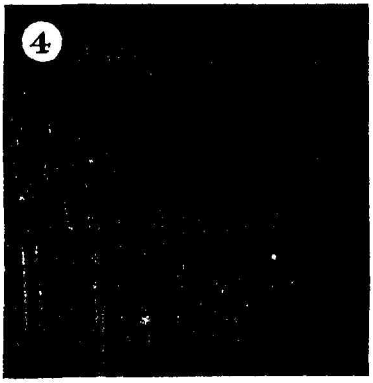


LONICERA QUINQUELOCULARIS.

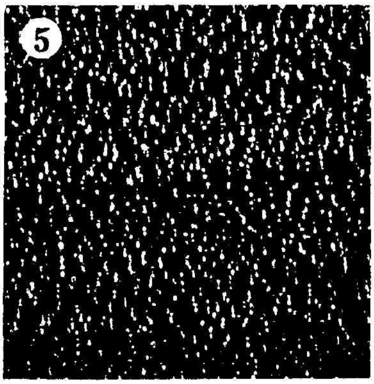


ANTHOCEPHALUS CADAMBA.

ADINA CORDIFOLIA.



RHODODENDRON ARBOREUM.



BASSIA LATIFOLIA.

DIOSPYROS MELANOXYLON.

(*Magnified* 3½ *times.*)

6. PENTAPYXIS, Hook. f.

1. **P. stipulata,** Hook. f.; Fl. Br. Ind. iii. 17; Gamble Darj. List 46. Vern. *Berikuru*, Nep.

A large shrub. *Bark* greyish-brown. *Wood* white, soft. *Pores* extremely small. *Medullary rays* fine and very fine. No annual rings.

Sikkim Himalaya, at 6–10,000 ft.; very common on hill-sides cleared of forest, around Darjeeling, and recognized by its very tomentose leaves and the presence of stipules.

E 2856. Rangbúl, Darjeeling, 7000 ft. (Gamble).

ORDER LIX. RUBIACEÆ.

A large and important forest Order containing many trees which are valuable for their timber, besides plants which have useful properties, chiefly as medicines and dyes. It contains 54 Genera, divided into 14 Tribes, viz.—

Tribe	I. Nauclee æ	Sarcocephalus, Anthocephalus, Cephalanthus, Adina, Stephegyne, Nauclea, Uncaria.
„	II. Cinchoneæ	Cinchona, Hymenopogon, Hymenodictyon, Luculia.
„	III. Rondeletieæ	Wendlandia, Greenea.
„	IV. Hedyotideæ	Hedyotis, Silvianthus.
„	V. Mussændeæ	Mussænda, Adenosacme, Myrioneuron, Aulacodiscus, Urophyllum.
„	VI. Gardenieæ	Webera, Byrsophyllum, Brachytome, Randia, Gardenia, Petunga, Morindopsis, Hyptianthera, Nargedia, Scyphostachys, Diplospora.
„	VII. Retiniphylleæ	Scyphiphora.
„	VIII. Guettardeæ	Guettarda, Timonius, Dichilanthe.
„	IX. Alberteæ	Octotropis.
„	X. Vanguerieæ	Canthium, Vangueria.
„	XI. Ixoreæ	Ixora, Pavetta, Coffea.
„	XII. Morindeæ	Morinda, Rennellia, Damnacanthus, Prismatomeris, Gynochthodes.
„	XIII. Psychotrieæ	Psychotria, Chasalia, Lasianthus, Saprosma, Hydnophytum.
„	XIV. Pæderieæ	Pæderia, Hamiltonia, Leptodermis.

Besides the genera described herein, which include such important ones as *Cinchona, Coffea* and *Morinda*, many genera contain plants of economic use. *Cephaëlis Ipecacuanha*, Rich., is the Ipecacuanha plant which has been largely propagated in India, but which has proved very difficult to naturalize or grow in such a way as to make its cultivation pay. "Madder" is given by *Rubia cordifolia*, Linn., the *Manjit* plant, common all over the Himalaya and largely exported. The well-known dye-plant *Oldenlandia umbellata*, Linn., Vern. *Chay*, Tel., is found in the sandy scrub of the Coromandel coast and largely collected. Many other genera are cultivated in gardens for the beauty of their flowers, and among the commonest of these are *Serissa, Catesbæa* and *Hamelia*, besides the numerous *Ixoras* and *Gardenias*, some species of which are described herein.

Wood white, yellow, or rarely red, close- and even-grained, generally hard or moderately hard; no heartwood. *Pores* small or very small; in *Anthocephalus Cadamba* and a few other species, moderate-sized. *Medullary rays* uniform, equidistant, fine or very fine, often closely packed. In *Morinda*, the pores collect in patches, but otherwise the structure is very uniform. Many of the species have woods resembling boxwood, and worthy of practical test to see if they could not be used as substitutes for it.

TRIBE I. NAUCLEEÆ.

I have been in doubt whether I should adopt the names and arrangement given in Mr. G. D. Haviland's "Revision of the Naucleeæ" in *Journ. Linn. Soc.* xxxiii. 1, but have concluded that it will be best to adhere, in this work, as closely as possible to the Fl. Br. Ind. instead, as it will facilitate references by Forest Officers using both works, and avoid the quotation of many synonyms.

1. SARCOCEPHALUS, Afzel.

1. S. cordatus, Miq.; Fl. Br. Ind. iii. 22; Bedd. Fl. Sylv. t. 318; Kurz For. Fl. ii. 63; Trimen Fl. Ceyl. ii. 292. *Nauclea cordata,* Roxb. Fl. Ind. i. 509. Vern. *Vammi,* Tam.; *Bakmí,* Cingh.; *Ma-ulettunshe,* Burm.

A deciduous tree. *Bark* silvery-grey, about 1 in. thick, smooth. *Wood* soft, sapwood light yellow, heartwood bright yellow. *Pores* moderate-sized, rather scanty, usually subdivided, in rough radial lines between the numerous fine *medullary rays* which bend round them.

Mixed forests of Burma; low country of Ceylon.

Kurz says the wood is soft and useless and decays in less than a year, and certainly the specimen, though of good colour, looks anything but durable. He gives W = 23 to 34 lbs. Beddome says that in Ceylon it is used for furniture, door-frames, sandals and other purposes. The tree is common in taungya clearings in Burma, and apparently comes up self-sown in plantations, and has to be cut out.

	lbs.
Ceylon Collection, No. 9, new (*Nauclea coadjunata,* Roxb.)	35

Nordlinger's Sections, vol. 6.

2. ANTHOCEPHALUS, A. Rich.

1. A. Cadamba, Miq.; Fl. Br. Ind. iii. 23; Bedd. Fl. Sylv. cxxvii. t. 35; Brandis For. Fl. 261; Gamble Darj. List 46; Talbot Bomb. List 105; Trimen Fl. Ceyl. ii. 293; *Nauclea Cadamba,* Roxb. Fl. Ind. i. 512. *Sarcocephalus Cadamba,* Kurz For. Fl. ii. 63. Vern. *Kaddam, karam,* Hind., Beng.; *Bol-kadam,* Chittagong; *Pandúr,* Lepcha; *Kodum,* Mechi; *Roghu,* Ass.; *Kadambo,* Uriya; *Kurambo,* Kurku; *Sanko,* Kól; *Vella cadamba,* Tam.; *Kadambe, rudrak-shamba,* Tel.; *Pedda soko,* Reddi; *Heltega, arsanatega,* Mysore; *Kadam, nhyu,* Mar.; *Kadda vailu, kadaga, kadwal,* Kan.; *Atta vanji,* Mal.; *Mauo, sanyepang,* Magh; *Ma-u, ma-ugaungdôn, ma-ukadôn,* Burm.; *Embul-bakmi,* Cingh.

A large deciduous tree. *Bark* dark grey, with numerous regular, longitudinal fissures, the outer bark peeling off in small rectangular scales. *Wood* white, with a yellowish tinge (an old specimen from Burma, yellowish-grey), soft, even-grained. *Pores* large, oval, elongated, subdivided, sometimes in short radial lines, scanty. *Medullary rays* fine, numerous, close together, bent outwards where they touch the pores. Structure very similar to that of *Sarcocephalus cordatus.*

Sub-Himalayan tract from Nepal eastwards, common in the Darjeeling Terai and lower hills; Assam and Eastern Bengal, very common; Northern Circars, scarce along rivers south to the Godavari, reappearing in Cuddapah and Kurmool; Western Coast in Kanara and Malabar; mixed forests of Pegu; low country of Ceylon up to 2000 ft.; much cultivated elsewhere.

A tall tree with straight clean stem and a rounded head, with rather drooping branches, flowers in yellowish heads the size of a golf-ball, or rather larger. S. E. Peal says it is remarkably quick-growing at first, up to eight or ten years old, afterwards the growth gets much slower; he considers that for tea-box planking it is best to fell it at twelve years old. He speaks also of its growth in height being as much as 10 ft. yearly for the first two or three years; and that trees sixteen years old often have a girth of 5 ft. (*Ind. Tea Gaz.,* 1884, and Ind. For., x. 245). The wood in Assam has often an unpleasant smell

The weight and transverse strength have been determined by the following experiments:—

Experiment by whom made.	Year.	Wood whence procured.	Weight.	No. of experiments.	Size of scantling.	Value of P.
			lbs.		ft. in. in.	
Puckle, No. 19	1859	Mysore	43	2	2 × 1 × 1	616
Kyd	1831	Assam	36	—	2 × 1 × 1	560
Cunningham	1854	Gwalior	47	5	2 × 1 × 1	618
Brandis, No. 67	1862	Burma	37	—	—	—
Wallich	—	Travancore	38	—	—	—
Specimens examined	1878-99	Various	36½	7	—	—

W may be taken as 40 lbs. per cubic foot on an average. The wood is used for building; in Assam, Cachar, and occasionally in Darjeeling for tea-boxes. Cunningham (1854) says that it is used for beams and rafters on account of its cheapness and lightness, and that it is good for joiners' work, but that it is a brittle wood. The flowers are offered at Hindu shrines, and the fruit is eaten. The tree is often cultivated for ornament, and is much used as an avenue tree in Bengal. Kurz, evidently quoting Brandis' List, No. 67, says "wood, a deep yellow;" this is not, however, the case with the specimens herein described.

The Kadam tree seeds profusely, and in a natural state seedlings spring up in abundance, but it is not so easy to propagate it artificially. As regards its natural seeding, S. E. Peal says (*l.c.*), "I once estimated that I weeded out 450,000 Roghu seedlings on 25 acres of clearance. It is a pity that it is not more extensively grown by planters and by Government, especially as it takes such a short time to reach useful size. It is on this latter account that I place it first on the list of tea-box timbers."

		lbs.
O 5093.	Gula Tappar, Dehra Dún (Babu U. N. Kanjilal)	37
E 650.	Rakti Forest, Darjeeling Terai (Manson)	40
E 3153.	Pankabari, Darjeeling (damp) (Gamble)	50
E 3144, 3280.	Jalpaiguri, Bengal (Gamble)	40
E 1435.	Assam	32
C 4210.	Ganjam Forests (Gamble)	25
B 2535.	Burma (Brandis, 1862)	32
	Nordlinger's Sections, vol. 10.	

3. CEPHALANTHUS, Linn. *C. naucleoides*, DC; Fl. Br. Ind. iii. 24; Kurz For. Fl. ii. 68 (*Nauclea tetrandra*, Roxb. Fl. Ind. i. 516); Vern. *Shwet kadam*, Beng., is an evergreen small tree of Oudh, the Sikkim Himalaya, Assam, Eastern Bengal and Upper Burma.

4. ADINA, Salisb.

Four species. *A. polycephala*, Benth.; Fl. Br. Ind. iii. 25 (*Nauclea polycephala*, Wall.; Kurz For. Fl. ii. 65), is an evergreen small tree of the Khasia Hills, Sylhet, Chittagong and Tenasserim.

Wood yellowish, moderately hard to hard, even-grained. *Pores* small, numerous. *Medullary rays* fine and very fine, numerous.

1. **A. cordifolia**, Hook. f.; Fl. Br. Ind. iii. 24; Brandis For. Fl. 263, t. 33; Gamble Darj. List 46; Talbot Bomb. List 105; Trimen Fl. Ceyl. ii. 293. *Nauclea cordifolia*, Roxb. Fl. Ind. i. 514; Bedd. Fl. Sylv. t. 33; Kurz For. Fl. ii. 66. Vern. *Haldu, hardu, karam*, Hind.; *Bangka, keli-kadam, petpuria, da-kôm*, Beng.; *Karam*, Nep.; *Tikkoe*, Bahraich and Gonda; *Hardu, paspu, kurmi*, Gondi; *Holonda*, Uriya; *Shangdong*, Gáro; *Roghu*, Ass.; *Kurúmba, komba*, Kól; *Karám*, Sonthal; *Mandugram*, Khond; *Manjakadambe*, Tam.; *Manja kadambu*, Mal.; *Bandaru, kamada, rudrakadapu, kanapu, rudraganapu, dúdagú, paspu kadambe*, Tel.; *Hedde, yettéga, yettagal, pettega, arsanatéga, yettada, ahnau*, Kan.; *Hedu, heddi, honangi*, Mar.; *Kolon*, Cingh.; *Thaing*, Magh: *Hnaw*. Burm.

A large deciduous tree. *Bark* soft, $\frac{1}{2}$ in. thick, grey, rough. *Wood* yellow, moderately hard, even-grained, no heartwood. *Annual rings* faint. *Pores* small, numerous, evenly distributed. *Medullary rays* very fine, short, numerous.

Deciduous forests in the greater part of India; in the sub-Himalayan tract and Lower Himalaya from the Jumna eastwards to Bhutan and up to 3000 ft.; common throughout Central, Western and South India; all over Burma in deciduous forest; dry region of Ceylon.

A beautiful and important tree, scattered in the deciduous forests, occasionally more or less gregarious in suitable localities, as on dry hills with a good soil, which have been subject to temporary cultivation. Its reproduction in ordinary forest is not good, as the seed is very small and requires broken-up soil on which it can fall and germinate easily. Artificially, it is difficult to rear, but would probably come up well from sowings on prepared land. In Northern India, the wood is much esteemed for combs and small articles of turnery, so that a good price is obtainable for the wood. In some forests, those of the Dehra Dún for instance, very large trees occur, but all much cut, pollarded or lopped, as, previous to the introduction of regular working, those who required small pieces preferred to pollard the trees or cut branches, to felling the whole tree. In South India, it is cut young for house-posts, so that large trees are rare.

The weight and transverse strength have been determined by the following experiments :—

Experiment by whom made.	Year.	Wood whence procured.	Weight.	No. of experiments.	Size of bar.	Value of P.
			lbs.		ft. in. in.	
Puckle, No. 26 . .	1859	Mysore	36	4	2 × 1 × 1	464
Skinner, No. 99. .	1862	South India	42	—	—	664
Cunningham . .	1854	Gwalior	49	2	2 × 1 × 1	586
Brandis . . .	1864	Burma	43	7	3 × 1 × 1	760
Brandis, No. 65. .	1862	„	42	—	—	—
R. Thompson . .	1868	Central Provinces	47	—	—	—
C. P. List . . .	1873	„ „	42	—	—	—
H. H. O'Connell .	1886	Coimbatore	47	—	—	$a = 0{\cdot}01183$
Bourdillon . .	1896	Travancore	43	—	—	—
Specimens examined.	1878–99	Various	45	15	—	—

W may be taken as 45 lbs. The wood seasons well, takes a good polish and is durable, but somewhat liable to warp and crack. It is good for turning, and is extensively employed in construction for furniture, agricultural implements, opium and cigar (Coconada) boxes, writing-tablets, combs and numerous other purposes.

Specimen D 3893 is a piece of wood taken out of a terraced roof at Ramandrug Bellary, 3500 ft., by E. D. M. Hooper. It had been up for 40 years, and was perfectly sound and good. It weighed 43 lbs. per cubic foot, and is supposed to have come from the Nallamalai forests in Kurnool.

		lbs.
O 215.	Garhwal (1868)	43
O 2994.	„ (1874)	46
O 1491.	Kheri, Oudh (Wood)	48
O 340.	Gorakhpur	41
C 825.	Bairagarh Reserve, Berar (Drysdale)	48
C 2988.	Jubbulpore (1863)	43
C 1136.	Ahiri Reserve, Central Provinces (R. Thompson) . . .	44
C 3686.	Palamow, Chota Nagpore (Gamble)	44
C 3543.	Khurdha Forests, Orissa „	43
C 1245.	Gumsúr, Madras (Dampier)	49
E 2387.	Bamunpokri, Darjeeling Terai (Gamble)	50
D 4015.	Collegal, Coimbatore	56
B 2538.	Burma (Brandis, 1862)	43
No. 35,	Salem Collection	40

2. **A. sessilifolia**, Hook. f.; Fl. Br. Ind. iii. 24; Brandis For. Fl. 264. *Nauclea sessilifolia*, Roxb. Fl. Ind. i. 515; Kurz For. Fl. ii. 65. Vern. *Kúm*, Beng.; *Kúmkoi*, Chakma; *Thaing*, Magh; *Teinkala*, Burm.

A large deciduous tree. *Bark* ⅓ to ½ in. thick, blackish, transversely fissured and cracked. *Wood* yellowish-brown, hard. *Pores* very numerous, moderate-sized, oval and subdivided, transverse diameter greater than the interval between the closely packed, fine, and uniform *medullary rays*.

Cachar, Chittagong, mixed forests of Burma, north to Myitkyina.

Weight, according to Brandis' Burma List of 1862, No. 70, 43 to 56 lbs.; specimens examined give 56 lbs. as an average. The wood is used in Chittagong for building purposes and firewood. In Chittagong it is perhaps the only gregarious tree, being commonly found on flat places on the banks of rivers.

		lbs.
E 1391.	Chittagong (Chester)	53
E 3694.	Chittagong Hill Tracts (Gamble)	58
B 2537, 3069.	Burma (1862)	56

3. **A. Griffithii**, Hook. f.; Fl. Br. Ind. iii. 24. *Cephalanthus naucleoides*, DC; Gamble Darj. List 46. Vern. *Kalé*, *kalikat*, Nep.

A small or moderate-sized tree. *Bark* light brown, rather smooth. *Wood* moderately hard: sapwood reddish, heartwood orange-yellow. *Pores* moderate-sized, numerous, often filled with a gummy substance. *Medullary rays* fine, numerous, undulating, bent round the pores.

Lower Himalaya from Nepal eastwards (scarce); Khasia Hills up to 3000 ft.

A pretty wood, used for planking formerly, but now scarce, in Darjeeling.

		lbs.
E 2385.	Chenga Forest, Darjeeling (Gamble)	44
E 5109.	Tista Valley, Darjeeling (C. G. Rogers)	40

5. STEPHEGYNE, Korth.

Three species.

Wood reddish- or yellowish-brown. *Pores* small to moderate-sized, not very numerous. *Medullary rays* fine, numerous, uniform. Wood cells usually rather large.

1. **S. parvifolia**, Korth.; Fl. Br. Ind. iii. 25; Brandis For. Fl. 262; Talbot Bomb. List 105; Trimen Fl. Ceyl. ii. 294. *Nauclea parvifolia*, Roxb. Fl. Ind. i. 513; Bedd. Fl. Sylv. t. 34; Kurz For. Fl. ii. 66. Vern. *Kulm*, Kashmir; *Kaddam*, *kallam*, *keim*, *kangei*, Hind.; *Phaldu*, Kumaon; *Mundi*, Gondi, Baigas; *Kutebi*, Kurku; *Gúri*, Koderma, Palamow; *Gúi*, *kómba*, Kól; *Goure karam*, Sonthal; *Goli karam*, Mal Pahari; *Kadiála*, Coorg; *Mundi-mundi*, Uriya; *Pajakiru*, Khond; *Kámba*, Palkonda; *Sima bandaru*, Reddi; *Chinna kadambu*, *chélampai*, *nir kadampa*, *buta-kadambe*, Tam.; *Nir-kadambe*, *karmi*, *bataganapu*, Tel.; *Congú*, *hedu*, *yetega*, *kadwar*, *kadani*, *kanu*, *bata kadapu*, *attaka*, Kan.; *Kadamb*, *karamb*, *kalam*, Mar.; *Sira kadamba*, Mal.; *Kambli*, Travancore Hills; *Tamák*, Bhíl; *Kumra*, Banswara; *Teinthe*, Burm.

A large deciduous tree. *Bark* ⅓ in. thick, light grey, smooth, with shallow depressions left by exfoliating scales. *Wood* light pinkish-brown, moderately hard, even-grained, much resembling that of *A. cordifolia*, but rather harder, and at once recognized by its different colour. *Pores* small, numerous, uniformly distributed. *Medullary rays* very fine, numerous, short.

All over India, in deciduous forest, except, apparently, in Northern and Eastern Bengal and Assam; sub-Himalayan tract and Lower Himalaya from Kashmir to Nepal, ascending to about 3000 ft.; Central, Western and Southern India; throughout Burma; dry region of Ceylon, but scarce.

A useful and important forest tree, classed with *Adina cordifolia*, but not quite so

much in demand and not so common. It is found rather sporadically only. Like Haldu, Keim gives a useful wood esteemed for many purposes, and in considerable demand especially in South India. Like Haldu, also, it reproduces very sparingly, but better where the soil has been broken up so that the small seeds can reach the ground without difficulty. It is difficult to rear artificially.

Growth moderate, 5 to 15, averaging 9 rings per inch of radius. The weight and transverse strength have been determined by the following experiments:—

Experiment by whom made.	Year.	Wood whence procured.	Weight.	No. of experiments.	Size of bar.	Value of P.
			lbs.		ft. in. in.	
Cunningham . . .	1854	Gwalior	35	2	2 × 1 × 1	586
Skinner, No. 100 . .	1862	South India	39	—	—	683
Brandis, No. 69 . .	1862	Burma	43	—	—	—
R. Thompson . . .	1868	Central Provinces	47	—	—	—
Bourdillon . . .	1896	Travancore	39	—	—	656

The specimens here described have an average weight of 46 lbs., and 45 lbs. may be taken as about a correct figure.

The wood is easily worked and polishes well; it is durable, if not exposed to wet. *It is used for building, furniture, agricultural implements, combs, cups, spoons and* platters, and for turned and carved articles.

			lbs.
P	458.	Ajmere	—
O	269.	Garhwal (1868)	45
O	529.	Dehra Dún (O'Callaghan)	41
O	344.	Gorakhpur	42
O	1481.	Kheri, Oudh (Wood)	44
C	178.	Mandla, Central Provinces (1870)	42
C	186.	" " " "	46
C	1120.	Ahiri Reserve, Central Provinces (R. Thompson) . . .	44
C	2783.	Melghát, Berar (Brandis)	44
C	824.	Bairagarh Reserve, Berar (Drysdale)	—
B	2539.	Burma (Brandis, 1862)	56

Nordlinger's Sections, vols. 7 and 10.

2. S. tubulosa, Hook. f.; Fl. Br. Ind. iii. 25; Bedd. Fl. Sylv. cxxviii.; Trimen Fl. Ceyl. ii. 295. Vern. *Helamba*, Cingh.

A small tree. *Bark* brown, smooth. *Wood* soft, light pinkish-brown. *Pores* small to moderate-sized, scanty, evenly distributed. *Medullary rays* fine, numerous, broader and longer than in *S. parvifolia.*

Cochin; moist region of Ceylon, common about Colombo.

Wood used in Ceylon for house-building.

	lbs.
No. 35, Ceylon Collection, old; No. 47, new (Mendis)	42

3. S. diversifolia, Hook. f.; Fl. Br. Ind. iii. 26. *Nauclea rotundifolia*, Roxb. Fl. Ind. i. 516; Kurz For. Fl. ii. 67 (also *N. parvifolia*, var. *diversifolia*). Vern. *Binga*, Burm.

A small deciduous tree. *Bark* thin, rough with longitudinal corky-swelled fissures. *Wood* yellowish-brown, moderately hard, even-grained. *Pores* small and moderate-sized, often subdivided. *Medullary rays* fine, uniform, numerous, the distance between them being less than the diameter of the pores, round which they bend.

Chittagong, Burma and the Andaman Islands, extending eastwards to the Shan Hills.

Brandis in Burma List, 1862, No. 66, gives W = 45 lbs. The wood is a nice one, but apparently not used.

		lbs.
B 2536.	Burma (Brandis, 1862)	51
B 2288.	Andaman (Col. Ford, 1866)	44

B 2233 (47 lbs.) Andaman (Col. Ford, 1866); Vern. *Htainbyoo*, is also this species in all probability. The wood is the same, but the pores are rather larger.

6. NAUCLEA, Linn.

Three species. *N. zeylanica*, Hook. f.; Fl. Br. Ind. iii. 26; Bedd. Fl. Sylv. cxxix.; Trimen Fl. Ceyl. ii. 296, is a small endemic Ceylon tree rather scarce in the moist low country of the island.

1. **N. purpurea,** Roxb. Fl. Ind. i. 515; Bedd. Fl. Sylv. cxxix.; Talbot Bomb. List 106 (also, probably, *N. elliptica*, Dalz. and Gibs., see remarks). Vern. *Phuga*, Mar.; *Ahnan*, Kan.

A small tree. *Wood* light red, smooth, moderately hard, even-grained. *Pores* small, evenly distributed. *Medullary rays* small, numerous, regular.

Forests of the Western Ghâts from the Konkan southwards; Northern Circars, in the Rumpa Hills.

The specimens came under the name *N. elliptica*, but the wood differs from Bourdillon's specimens of *N. missionis*, under which *N. elliptica* is placed in Fl. Br. Ind., that I feel I am right in thinking it is really *N. purpurea* with which, and not with *N. missionis*, Talbot would evidently join *N. elliptica*.

		lbs.
W 4191.	Cochin (Kohlhoff)	49
W 1225.	North Kanara (Barrett)	42

2. **N. missionis,** Wall.; Fl. Br. Ind. iii. 27; Talbot Bomb. List 106.

A small tree. *Wood* yellow, soft to moderately hard. *Pores* small to moderate-sized, often subdivided into 2 or 3 by partitions. *Medullary rays* fine, numerous, bent where they touch the pores.

Western Coast, along rivers and watercourses, from the Konkan to Travancore. Bourdillon gives W = 37 lbs., P = 430.

		lbs.
W 4673.	Travancore (Bourdillon)	34

7. UNCARIA, Schreb. About nine species, all climbing shrubs. *U. pilosa*, Roxb. Fl. Ind. i. 520; Fl. Br. Ind. iii. 32; Kurz For. Fl. ii. 70; Gamble Darj. List 47; Vern. *Baisi kara*, Nep.; *Kahukrik*, Lepcha, is a straggling shrub of Sikkim, Eastern Bengal and Burma with large hooked sterile peduncles in the shape of a buffalo's horn. *U. sessilifructus*, Roxb. Fl. Ind. i. 520; Fl. Br. Ind. iii. 30; Kurz For. Fl. ii. 71; Gamble Darj. List 47; Vern. *Pinri*, Lepcha, is a climber of Sikkim, Eastern Bengal, Chittagong and Burma. *U. sclerophylla*, Roxb. (*U. ferruginea*, DC; Kurz For. Fl. ii. 69); *U. attenuata*, Korth.; *U. lævigata*, Wall.; and *U. macrophylla*, Wall. (*U. sessilifolia*, Roxb.; Kurz For. Fl. ii. 69), are all large climbing shrubs of Burma. *U. dasyoneura*, Korth.; Trimen Fl. Ceyl. ii. 296, is a very large climbing shrub of Ceylon. *U. Gambier*, Roxb. Fl. Ind. i. 517; Fl. Br. Ind. iii. 31, is the climbing shrub of the Malay Archipelago whose leaves produce the astringent extract called "Gambier," or "Terra japonica," which is used as a dye and for chewing with pán leaves and areca nut in the same way as cutch is in India. The plant is not indigenous in India, Burma or Ceylon.

Tribe II. CINCHONEÆ.

8. CINCHONA, Linn.

A genus of about 36 species of trees or shrubs found in a narrow belt along the Andes of South America, between 2300 and 8000 ft. elevation. Several species give the Peruvian bark or Cinchona of commerce, the value of which depends upon the

presence of certain alkaloids which are known as "quinine," "cinchonine," "cinchonidine," etc., and which are so valuable as febrifuges.

The Cinchona trees were first brought to India in 1860, chiefly through the labours of Sir Clements Markham, K.C.B., who was sent by the Secretary of State in 1859 to Peru to collect plants and seeds of the different kinds. The plants he brought did not live, but the seeds were sown and the trees planted in the Nilgiri Hills. In 1862 Dr. T. Anderson instituted the plantations at Rangbi in Sikkim with plants and seeds brought by him from Java. There are 4 principal species cultivated in the Indian plantations, viz. *C. succirubra*, *Calisaya*, *officinalis* and *micrantha*, with hybrids and varieties of these. The Government has large plantations in the Darjeeling Hills at Mongpu, Sitong, etc., and in the Nilgiris at Doddabetta, Naduvatam, etc., while in the South Indian and Ceylon hills there are also plantations belonging to private persons. The extended cultivation of Cinchona in suitable localities all over the world has reduced the cost of quinine, so that the invaluable drug is now within the reach of the poorest. The exertions of Sir G. King have procured its sale in small packets of five grains each and of a pice in value at many of the post-offices in India, rendering it easy for poor people to obtain small doses.

1. **C. succirubra**, Pavon; Brandis For. Fl. 265. Red Bark.

Wood yellow, moderately hard. *Pores* small, in short radial lines. *Medullary rays* closely packed, fine and very fine, short.

Cultivated on the Nilgiris and other hills of South India, at the plantations of Rangbi and Poomong in Sikkim, on the hills east of Toungoo in Burma and in parts of the Satpura Range in Central India. This species thrives at a lower elevation than the others, but is comparatively poor in quinine, though rich in cinchonine and cinchonidine. From this species was chiefly derived the "Cinchona alkaloid," which for some time was largely manufactured at the Government Plantation of Rangbi.

E 1357, 3157. Rangbi, Darjeeling, 3700 ft. (King).
Nordlinger's Sections, vol. 10.

2. **C. Calisaya**, Weddell; Brandis For. Fl. 266. Yellow Bark.

Wood reddish-grey, moderately hard, even-grained. *Pores* small, in short radial lines. *Medullary rays* fine, closely packed, short.

Cultivated in Sikkim at moderate elevations.

It yields perhaps the most valuable of the Cinchona barks, rich in alkaloids, among which quinine forms half to four-fifths.

E 1358, 3158. Rangbi, Darjeeling, 3700 ft. (King).

3. **C. officinalis**, Linn.; Brandis For. Fl. 266. Loxa or Crown Bark.

Wood yellowish-grey, similar in structure to that of *C. Calisaya*.

Cultivated at high elevations on the Nilgiris, in Ceylon and in Sikkim, but not extensively.

Its bark is rich in alkaloids, of which more than one-half is quinine.

E 1356, 3159. Rangbi, Darjeeling, 3700 ft. (King).
Nordlinger's Sections, vol. 10.

9. HYMENOPOGON, Wall. Two species. *H. parasiticus*, Wall.; Fl. Br. Ind. iii. 34; Kurz For. Fl. ii. 73; Gamble Darj. List 47; Vern. *Kursimla*, Nep., is an epiphytic shrub of the East Himalaya, Khasia Hills and Burma, above 4000 ft. *H. assamicus*, Hook. f. is a similar plant of Assam.

10. HYMENODICTYON, Wall.

Three species. *H. flaccidum*, Wall.; Fl. Br. Ind. iii. 36; Brandis For. Fl. 268; Gamble Darj. List 47, is a tree of the Central and Eastern Himalaya from Garhwal to Bhutan, ascending to 6000 ft.; and of the Khasia Hills at 4–5000 ft.

1. **H. excelsum**, Wall.; Fl. Br. Ind. iii. 35; Brandis For. Fl. 267; Bedd. Fl. Sylv. cxxx.; Talbot Bomb. List 106; Gamble Darj. List 47. *H. utile*, Wight; Bedd. Fl. Sylv. cxxx. *H. thyrsiflorum*, Wall.; Kurz For. Fl. ii. 72. *Cinchona excelsa*,

Roxb. Fl. Ind. i. 529. *C. thyrsiflora*, Roxb. *l.c.* 530. Vern. *Bartu, barthoa*, Pb.; *Bhaulan, bhalena, bhamína, dhauli, kúkúrkat, bhúrkúl, phaldu, bhohár, potúr, purgur*, Hind.; *Bauranga*, Kumaon; *Lunia, lamkana*, Merwara; *Bhorsál*, Melghât; *Bhorkoru*, Monghyr; *Bhawasar*, Kurku; *Sali*, Kól; *Burkunda*, Bhunij; *Dadhippa*, Reddi; *Dondru, dandelo*, Panch Mehals; *Bhoursál*, Mar.; *Sagapu, peranjoli*, Tam.; *Dudiyetta, dudippa, chetippa, burja, bandara, monnabillu*, Tel.; *Vella kadamba*, Mal.; *Bodoka, konso*, Uriya; *Kusan*, Burm.

A large deciduous tree. *Bark* soft, ½ to ¾ in. thick, grey, exfoliating in irregularly shaped, softish scales. *Wood* white, when cut up fresh; if cut up dry, brownish-grey, soft. *Annual rings* indistinctly marked. *Pores* moderate-sized, scanty, single or subdivided. *Medullary rays* few moderately broad, alternating with others fine, visible as a silver-grain on a radial section, bent round the pores. Wood-cells large.

Throughout India in dry deciduous forest; in the sub-Himalayan tract and lower Himalaya from the Ravi eastwards, ascending to 5000 ft.; Central, Western and South India; dry forests in Burma.

A conspicuous tree, especially when leafless but still bearing its panicles of fruit with small winged seeds. It is chiefly found in dry mixed forests, often on stony or sandy river-banks, often again in savannah forests. The growth is moderate, 6 to 7 rings per inch of radius. The wood is soft, but of good quality for purposes for which a soft wood is useful. It would do for tea-boxes, and is in use for scabbards, grain-measures, palanquins, toys, and in Burma for school "slates" and packing-cases. Brandis' Burma List of 1862, No. 104, gave W = 28 lbs.; Bourdillon gives W = 28, P = 447; the weight of the specimens here enumerated averages 31 lbs. The bark is said to give an alkaloid allied to quinine, and is used in native medicine as an antiperiodic.

		lbs.
O 216.	Garhwal (1868)	28
O 350.	Gorakhpur (1868)	—
O 1462.	Bahraich, Oudh (Eardley-Wilmot)	32
O 1482.	Kheri, Oudh (Wood)	34
O 4424.	Siwalik Hills, Dehra Dún (Gamble)	30
C 1127.	Ahiri Reserve, C.P. (R. Thompson)	32
C 3565.	Khurdha Forests, Orissa (Gamble)	29
E 1231.	Sibságar, Assam (Mann)	26
E 1286.	Cachar (Mann)	34
B 279.	Burma (1867)	31
B 3070.	Burma (Brandis, 1862)	38
B 559.	Prome, Burma (Ribbentrop)	33
B 2287.	Andaman Islands (Col. Ford, 1866)	35

Nordlinger's Sections, vol. 9.

2. **H. obovatum**, Wall.; Fl. Br. Ind. iii. 36; Bedd. Fl. Sylv. t. 219; Talbot Bomb. List 106. Vern. *Karwai, sirid*, Mar.; *Yella malla kai*, Tam.; *Mallay tanák*, Madura.

A large tree. *Wood* brownish-grey, soft, smooth. *Pores* scanty, moderate-sized, single or subdivided radially. *Medullary rays* few moderately broad, alternating with others fine, forming a silver-grain on a radial section. Very like that of *H. excelsum*.

Western Ghâts from the Konkan to Travancore.

		lbs.
W 4674.	Travancore (Bourdillon)	28

11. LUCULIA, Sweet.

Two species. *L. Pinceana*, Hook. is a shrub of the Khasia Hills, at 3–5000 ft.

1. **L. gratissima**, Sweet; Fl. Br. Ind. iii. 36; Kurz For. Fl. ii. 71; Gamble Darj. List 47. Vern. *Dowari*, Nep.; *Sumbrangrip*, Lepcha.

A large shrub. *Bark* brown, very thin. *Wood* white, moderately hard, close- and even-grained. *Pores* very small, numerous. *Medullary rays* fine, regular. *Pith* large.

Eastern Himalaya, in Nepal and the Darjeeling Hills at 4–6000 ft.; Shan Hills of Burma.

Wallich gives W = 23 lbs. (No. 43). Flowers pink, very handsome.

E 5008. Kurseong Forests (Green).

TRIBE III. RONDELETIEÆ.

12. WENDLANDIA, Bartling.

About 14 Indian species, all handsome trees or small trees with flowers in terminal thyrsoid cymes. *W. puberula*, DC; Fl. Br. Ind. iii. 38; Brandis For. Fl. 576 (*W. scabra*, Kurz For. Fl. ii. 73), is an evergreen small tree of the Central Himalaya from the Jumna river to Nepal and of Upper Burma, ascending to 4000 ft. *W. Wallichii*, W. and A., *W. coriacea*, DC and *W. paniculata*, DC are all small trees of the Eastern Himalaya, at about 2–4000 ft. in Sikkim, some extending to Assam, the Khasia Hills and Sylhet, the last-named to the Kachin Hills. *W. nitens*, Wall. and *W. glomerulata*, Kurz, are found in Tenasserim; and *W. ligustrina*, Wall.; Vern. *Damasegyi*, Burm., in the Taongdong Hills in Upper Burma. *W. glabrata*, DC; Fl. Br. Ind. iii. 39; Kurz For. Fl. 74; Vern. *Thitpyu*, Burm. is an evergreen tree of the dry hill forests of the Shan States, Martaban and Tenasserim at 2–4000 ft.; also found in the S. Deccan and Mysore, where too occurs *W. Lawii*, Hook. f. *W. pendula*, DC and *W. angustifolia*, Wight are species which, like *W. Notoniana*, have whorled leaves and are found, the former in Nepal, the latter in the hills of Tinnevelly.

Wood reddish-brown. *Pores* small, evenly distributed. *Medullary rays* of two kinds, very fine and fine or moderately broad, numerous.

1. W. exserta, DC; Fl. Br. Ind. iii. 37; Bedd. Fl. Sylv. cxxx.; Brandis For. Fl. 268; Gamble Darj. List 47; Talbot Bomb. List 107. *Rondeletia exserta*, Roxb. Fl. Ind. i. 523. Vern. *Chaulai, chila, chilkiya, tíla, birsa, tilki, tilai*, Hind.; *Bathna, chaulai*, Saharanpur; *Chelitana, kattito*, Kumaon; *Chilkia posára*, Garhwal; *Tilka*, Bahraich; *Kangi, tilki, mimri*, Nep.; *Kúrsi*, Seoni; *Marria*, Gondi; *Tilliah*, Baigas; *Honro*, Sonthal; *Tirúwa*, Mal Pahari; *Tilai*, Koderma; *Tilai*, Uriya; *Tieko*, Khond.

A small deciduous tree. *Bark* brown. *Wood* reddish-brown, hard, close-grained. *Pores* small, evenly distributed. *Medullary rays* moderately broad and fine, the former short. *Annual rings* marked by fewer pores in the autumn wood.

Sub-Himalayan tract and Lower Himalaya from the Chenab eastwards; Oudh, Bengal and Central India, in deciduous forests; also in Orissa and the Circars on the East and in the North Deccan and the Konkan on the West Coast.

An ornamental tree with ashy-grey foliage and large thyrsoid panicles of fragrant white flowers. Brandis speaks of it as gregarious in dense patches, to the exclusion of other trees, in the Bahraich and Gonda forests of Oudh; and I have seen it similarly growing in places in Chota Nagpore, the Deccan and Circars. Brandis also mentions its partiality for broken raviny ground near the Narbadda river; and on the Saharanpur and Dehra Dún Siwaliks I have found it coming up in dense patches of seedlings on the débris of the sand- and shingle-slips which so often occur there. This habit points to its being likely to be of use in sowings for reclothing such places and for any works that may be tried in Hoshiarpur. It ought to do well, as J. L. Stewart mentions, that Edgeworth found plants springing up far down in the Punjab plains, from seeds carried down the rivers ("Pb. Plants," 118).

Growth fast, 4 to 5 rings per inch of radius. The wood is occasionally used for building and agricultural implements and for house-posts in the Sikkim Terai.

		lbs.
O 1370.	Gonda, Oudh	47
E 589.	Khookloong Forest, Darjeeling Terai (Manson)	—

Nordlinger's Sections, vol. 9 (*W. excelsa*).

2. W. tinctoria, DC; Fl. Br. Ind. iii. 38; Brandis For. Fl. 269; Bedd. Fl. Sylv. cxxx.; Kurz For. Fl. ii. 74; Gamble Darj. List 47. *Rondeletia tinctoria,* Roxb. Fl. Ind. i. 522. Vern. *Padhera,* Kumaon; *Kat moliya,* Garhwal; *Túla-lodh,* Beng.; *Kangi,* Nep.; *Singnok,* Lepcha; *Telli,* Uriya; *Tilai,* Sonthal; *Tilki,* Khond; *Tama-sauk, thitni, thitpyu,* Burm.

A small tree. *Bark* ½ in. thick, reddish-brown, fibrous, rough. *Wood* reddish-yellow, soft. *Pores* small, uniformly distributed. *Medullary rays* fine, short, numerous, with a fine silver-grain.

Sub-Himalayan tract from the Ganges eastward up to 5000 ft., in deciduous forests; Assam, Khasia Hills and Eastern Bengal; Orissa and the Northern Circars to the Godavari; dry forests throughout Burma, and up to 4000 ft., extending north to Myitkyina.

Common in the Sikkim Hills, Assam and Burma as a small, rather crooked tree. The bark is used as a mordant in dyeing.

C 3791. Rogada Forest, Ganjam (Gamble).

3. W. Notoniana, Wall.; Fl. Br. Ind. iii. 40; Bedd. Fl. Sylv. t. 224; Talbot Bomb. List 107; Trimen Fl. Ceyl. ii. 297. Vern. *Showla,* Mar.; *Puvu, thovara,* Trav. Hills; *Rawanidala,* Cingh.

A small tree. *Bark* orange-red, peeling off in fibrous strips. *Wood* dark reddish-brown, moderately hard, even-grained. *Pores* small, evenly distributed. *Medullary rays* fine, numerous, some very fine.

Forests of the Konkan and N. Kanára, on the Gháts, especially on laterite; Nilgiris and other hills of South India at 5–8000 ft. as a shrub only; common in Ceylon at all elevations.

	lbs.
No. —, Ceylon (Alexander)	53

No. 74, Ceylon Collection (old)—A. Mendis—48 lbs. was probably this species (see Ed. i. p. 226), but No. 119 (new) is something else with quite different structure.

13. GREENEA, W. and A.

Two species, evergreen shrubs or small trees of Tenasserim, viz. *G. Jackii,* W. and A.; Fl. Br. Ind. iii. 41 (*Wendlandia corymbosa,* DC; Kurz For. Fl. ii. 75) and *G. Wightiana,* W. and A.; Fl. Br. Ind. iii. 41 (*Wendlandia secunda,* Griff.; Kurz For. Fl. ii. 75).

Tribe IV. HEDYOTIDEÆ.

14. HEDYOTIS, Linn.

A genus containing a number of small shrubs, common in the hills of South India and Ceylon, besides one or two climbers and a number of herbaceous plants. Many of them seem to be very local in their distribution. *H. fruticosa,* Linn.; Fl. Br. Ind. iii. 49; Trimen Fl. Ceyl. ii. 304; Vern. *Weraniya,* Cingh., is a very common shrub of the low country of Travancore and Ceylon, up to 3000 ft. *H. swertioides,* Hook. f. is a tall species found in the Pulney Hills. *H. Lessertiana,* Arn.; Trimen Fl. Ceyl. 309, t. 49, is a large erect shrub, often almost a small tree, very common, in the mountains of Ceylon and conspicuous. *H. scandens,* Roxb. Fl. Ind. i. 364; Fl. Br. Ind. iii. 57; Gamble Darj. List 47; Vern. *Bakrelara,* Nep.; *Kalhenyok,* Lepcha, is a climbing shrub of the Eastern Himalaya, Khasia Hills and Eastern Bengal, ascending to 6000 ft. and used by Lepchas in the Darjeeling Hills in dyeing their cloths green or blue.

1. H. stylosa, Br.; Fl. Br. Ind. iii. 51.

A large shrub, with stems much and deeply indented on all sides. *Bark* thin, rough, purplish-brown. *Wood* dark greyish-brown, moderately hard. *Pores* very small, scanty. *Medullary rays* very numerous, close and fine. *Annual rings* marked by clouded bands.

Hills of South India, very common in the Nilgiri sholas, at 5–8000 ft.

W 3912. Ootacamund, 7000 ft. (Gamble).

2. H. articularis, Br.; Fl. Br. Ind. iii. 51.

A small shrub. *Bark* brown, corky. *Wood* dark greyish-brown, hard, close-grained. *Pores* extremely small, scanty. *Medullary rays* extremely fine, numerous.

Nilgiri Hills, at 5–7000 ft., fairly common.

W 4186. Naduvatam, Nilgiris, 7000 ft. (Gamble).

3. H. hirsutissima, Bedd.; Fl. Br. Ind. iii. 55.

A shrub. *Bark* light brown, with somewhat hexagonal, thick, corky prominences. *Wood* dark grey, moderately hard, even-grained. *Pores* very small, rather scanty, single or in short transverse patches of lighter tissue. *Medullary rays* very fine, numerous.

Nilgiri Hills, scarce, only seen on the Kundahs above Sispara, at about 6–7500 ft.

		lbs.
W 3770, 3808.	Sispara, Nilgiris, 7000 ft. (Gamble)	43

15. SILVIANTHUS, Hook. f. *S. bracteatus*, Hook. f.; Fl. Br. Ind. iii. 86, is a shrub of Sylhet and Cachar.

TRIBE V. MUSSÆNDEÆ.

16. MUSSÆNDA, Linn.

A genus containing 11 described species of which four or more are large shrubs or climbers. It is remarkable for having flowers with one of the lobes of the calyx enlarged into a membranous usually white leaf, so that the plants are conspicuous in the forest. The corollas are mostly orange-coloured. *M. macrophylla*, Wall.; Fl. Br. Ind. iii. 89; Gamble Darj. List 48 (*M. calycina*, Wall.; Kurz For. Fl. ii. 58), is a large shrub or small tree of the Eastern Himalaya at 4–6000 ft., the Khasia Hills, Burma, and the Andaman and Nicobar Islands. *M. glabra*, Vahl.; Fl. Br. Ind. iii. 90; Kurz For. Fl. ii. 56; Gamble Darj. List 48, is a climbing or erect shrub or small tree of the Central and Eastern Himalaya at 1–5000 ft., the Khasia Hills, the hills of Eastern Bengal and those of Martaban.

1. M. frondosa, Linn.; Fl. Br. Ind. iii. 89; Roxb. Fl. Ind. i. 557; Bedd. Fl. Sylv. cxxi.; Gamble Darj. List 48; Talbot Bomb. List 107; Trimen Fl. Ceyl. ii. 323. Vern. *Bhútkes, lavasat, sherwod*, Mar.; *Bebana*, Bombay; *Asari*, Nep.; *Tumberh*, Lepcha; *Mussenda, welbutsarana*, Cingh.;

A large shrub or (var. *hirsutissima*) large climber. *Bark* grey, smooth but granular. *Wood* white, soft to moderately hard, close- and even-grained. *Pores* very small, numerous, evenly distributed. *Medullary rays* very fine, regular, short.

Eastern Himalaya up to 4000 ft.; Assam, the Khasia and Shan Hills; Western Coast and South India; Ceylon: often cultivated.

		lbs.
E 5080.	Outer Darjeeling Hills (Green)	42
	Nordlinger's Sections, vol. 3 (*M. flavescens*, Karst.).	

17. ADENOSACME, Wall. Small shrubs of the undergrowth of damp forests recognizable by their white berries. *A. longifolia*, Wall.; Fl. Br. Ind. iii. 95; Kurz For. Fl. ii. 54; Gamble Darj. List 48; Vern. *Pitamari*, Nep., is the principal species and is found in the forests of N. and E. Bengal and Burma; while *A. Lawii*, Hook. represents it in those of the Western Gháts of S. India.

18. MYRIONEURON, Wall. Three species, small shrubs of no importance. *M. nutans*, Wall.; Fl. Br. Ind. iii. 96; Kurz For. Fl. ii. 55, is common in Assam, the Khasia Hills and Chittagong.

19. AULACODISCUS, Hook. f. *A. premnoides*, Hook. f.; Fl. Br. Ind. iii. 97, is a small glabrous tree of Tenasserim or the Andaman Islands.

20. UROPHYLLUM, Wall. Four species, shrubs or small trees, of which two are found in Tenasserim and two in Ceylon. They are all scarce except *W. zeylanicum*, Thw.; Fl. Br. Ind. iii. 98; Bedd. Fl. Sylv. cxxxi.; Trimen Fl. Ceyl. ii. 326; Vern. *Wal-handun*, Cingh., which is common in the Ceylon Hills at 3–7000 ft.

In the Tribe *Hameliеæ* comes *Hamelia patens*, Jacq., a well-known small West Indian tree cultivated in Indian gardens.

Bark dark-brown, thin, with corky lenticels. *Wood* yellowish-brown, moderately hard, even-grained. *Pores* small, uniformly distributed, often subdivided. *Medullary rays* fine, numerous, regular. Growth rather fast, 4 to 5 rings per inch.

	lbs.
O 4666, 4738. Forest School Garden, Dehra Dún (Gamble) . . .	39

TRIBE VI. GARDENIEÆ.

21. WEBERA, Schreb.

Eleven or twelve species, shrubs or small trees, of little interest except the common species here described. *W. odorata*, Roxb. Fl. Ind. i. 699; Fl. Br. Ind. iii. 103; Vern. *Patagrúja*, Beng., is a small tree of Assam, the Khasia Hills and Sylhet. *W. lucens*, Hook. f. and *W. nilagirica*, Hook. f. are found in the Nilgiri sholas.

1. **W. corymbosa,** Willd.; Roxb. Fl. Ind. i. 696; Fl. Br. Ind. iii. 102; Trimen Fl. Ceyl. ii. 328. *W. asiatica*, Bedd. Fl. Sylv. cxxxiii.; Talbot Bomb. List 107. *W. glomeriflora*, Kurz For. Fl. ii. 47. Vern. *Kankra*, Beng.; *Kachária chál*l, Cuttack; *Kommi, komi*, Tel.; *Jhaujhauka*, Uriya; *Karé*, Mar.; *Kúra, pavetti*, Tam.; *Tarana*, Cingh.

A large evergreen shrub or small tree. *Wood* light-brown, hard, close- and even-grained. *Pores* very small, very numerous, uniformly distributed. *Medullary rays* short, fine and extremely fine, regular. *Pith* cross-shaped.

Bengal, Orissa and the Circars; Deccan and Carnatic; Western Coast from the Konkan southwards; tropical forests of the Pegu Yoma in Burma.

A common plant in the Circars, Deccan and Carnatic, especially remarkable for its shining hard leaves and white flowers. A. Mendis says the wood is used in Ceylon for fishing-boats, and Trimen that it is used in constructing granaries.

	lbs.
C 3579, 3520. Khurdha Forests, Orissa (Gamble)	—
D 4231. Cuddapah Forests (Gamble)	47
W 4545. Travancore (Bourdillon)	63
No. 84 (old), 132 (new), Ceylon Collection (A. Mendis) . . .	57

22. BYRSOPHYLLUM, Hook. f. Two species. *B. ellipticum*, Hook. f.; Fl. Br. Ind. iii. 107; Trimen Fl. Ceyl. ii. 329, is a small tree of the moist low country of Ceylon; and *B. tetrandrum*, Hook. f.; Fl. Br. Ind. iii. 107; Bedd. Fl. Sylv. cxxxiv.–2, t. 326, is a small tree of the hills of Travancore at 5000 ft.

23. BRACHYTOME, Hook. f. *B. Wallichii*, Hook. f.; Fl. Br. Ind. iii. 108; Kurz For. Fl. ii. 51, is an evergreen shrub or small tree of the Khasia Hills at 3–4000 ft. and the hills of Upper Burma.

24. RANDIA, Linn.

About 16 species, shrubs or small trees, many of them thorny. *R. tomentosa*, Blume; Fl. Br. Ind. iii. 110, is a large shrub of the forests of the Shan Hills, Martaban and Tenasserim. *R. longiflora*, Lamk.; Fl. Br. Ind. iii. 111 (*Webera scandens*, Roxb. Fl. Ind. i. 698. *Posoqueria longiflora*, Roxb. Fl. Ind. i. 718); Vern. *Gujerkota*, Sylhet, is a large shrub of Assam, the Khasia Hills and Eastern Bengal. *R. Griffithii*, Hook.

f.; Fl. Br. Ind. iii. 112, is a small tree of the Khasia Hills. *R. densiflora*, Benth.; Fl. Br. Ind. iii. 112 (*Webera oppositifolia*, Roxb. Fl. Ind. i. 698; Kurz For. Fl. ii. 47), is a small evergreen tree of Assam, Eastern Bengal, Burma and the Andaman Islands, with "wood yellowish-white turning brown, heavy, very close-grained, and of a very fine grain (Kurz)." *R. Wallichii*, Hook. f.; Fl. Br. Ind. iii. 113; Gamble Darj. List 48, is a tree of the forests of the East Himalaya, the Khasia Hills, Sylhet, Chittagong, and the Kachin Hills. *R. rugulosa*, Thw.; Fl. Br. Ind. iii. 113; Bedd. Fl. Sylv. cxxxiii.; Talbot Bomb. List 108; Trimen Fl. Ceyl. ii. 331 (*R. speciosa*, Bedd. Fl. Sylv. cxxxiii.), is a climbing or creeping shrub of the forests of the Western Gháts from the Konkan southwards and Ceylon. *R. sikkimensis*, Hook. f.; Fl. Br. Ind. iii. 114; Gamble Darj. List 48, is a shrub of the lower Darjeeling Hills with handsome large flowers. *R. exaltata*, Griff.; Fl. Br. Ind. iii. 114 (*Gardenia pulcherrima*, Kurz For. Fl. ii. 43), is a medium-sized evergreen tree of the tropical forests of S. Andaman. *R. hygrophila*, Kurz; Fl. Br. Ind. iii. 115; Kurz For. Fl. ii. 44, is an evergreen shrub of swampy forests in Pegu.

Wood creamy-white, light brown or greyish-brown, smooth, close-grained, hard. *Pores* small or very small, evenly distributed. *Medullary rays* fine and very fine, numerous.

The woods of the species described are very uniform and in all of them they have the character of boxwood.

1. **R. tetrasperma,** Hook. f.; Fl. Br. Ind. iii. 109; Brandis For. Fl. 272. *Gardenia tetrasperma*, Roxb. Fl. Ind. i. 700. Vern. *Bhadru*, Jaunsar; *Bara garri, botya gingaru*, Kumaon.

A small erect or procumbent shrub. *Wood* light greyish-brown, hard, close- and even-grained. *Pores* very small, evenly distributed. *Medullary rays* very fine, very numerous. Numerous medullary patches.

West Himalaya from the Indus to Bhutan; Assam and Sylhet; ascending to 6000 ft.

		lbs.
H 157, 2821.	Simla, 5–6000 ft. (Gamble)	56
H 4708.	Tons bank, Jaunsar, 3000 ft. (Gamble)	56

2. **R. fasciculata,** DC; Fl. Br. Ind. iii. 109; Gamble Darj. List 48. *R. rigida*, DC; Brandis For. Fl. 273. *Posoqueria fasciculata*, Roxb. Fl. Ind. i. 717. *Webera fasciculata*, Kurz For. Fl. ii. 49.

A shrub. *Wood* light greyish-brown, hard, close-grained. *Pores* small, numerous, uniformly distributed. *Medullary rays* fine and very fine, very numerous.

Eastern Himalaya from Nepal to Bhutan, up to 4000 ft.; Assam, Khasia Hills, Eastern Bengal and Tenasserim.

E 3363. Dhupguri, W. Dúars (Gamble).

3. **R. uliginosa,** DC; Fl. Br. Ind. iii. 110; Bedd. Fl. Sylv. cxxxii.; Brandis For. Fl. 273; Kurz For. Fl. ii. 44; Gamble Darj. List 48; Talbot Bomb. List 108; Trimen Fl. Ceyl. ii. 330. *Posoqueria uliginosa*, Roxb. Fl. Ind. i. 712. Vern. *Pindálu, pindar, panár, paniah, bharani, katúl*, Hind.; *Pirár*, Oudh; *Mandeo*, Kumaon; *Mainphal*, Garhwal; *Piralo*, Beng.; *Maidal*, Nep.; *Kaurio*, Panch Mehals; *Pendra*, Uriya; *Katil, pender*, Gondi; *Gangru, gangáru*, Kurku; *Gadda pirar*, Monghyr; *Púrpúta*, Melghat; *Kúmkúm*, Kól; *Pindé*, Sonthal; *Pindaro*, Mal Pahari; *Nallaika, nalla kakisha*, Tel.; *Wagutta*, Tam.; *Karé, pendri*, Kan.; *Karu*, Mal.; *Telphetru, panelra, phetra, pindra*, Mar.; *Tapkél*, Bhíl; *Hmanbyu*, Burm.; *Et-kukuruman, wadiga*, Cingh.

A small deciduous tree. *Bark* ⅓ in. thick, reddish-brown, exfoliating in thin flakes. *Wood* whitish-grey, close-grained, hard, no heartwood. *Annual rings* marked by a narrow belt without pores. *Pores* small and very small, numerous, uniformly distributed. *Medullary rays* fine and very fine, very numerous, distinctly visible on a radial section.

Sub-Himalayan tract from the Jumna eastwards, Oudh, Bengal, Burma, Central and South India, in savannah forests, and in wet places.

This rather curious little tree has large white flowers often 2 in. in diameter, and a large guava-like fruit. It is characteristic of open swampy places and savannah grass lands, in old rice-fields (Talbot) and tank margins (Trimen), and usually stands alone or in groups of two or three together. Growth moderate, 6 to 7 rings per inch of radius. The wood is one of the possible boxwood substitutes. Weight: the average of the specimens gives 48 lbs. per cubic foot; Brandis says 41 lbs. The fruit is eaten.

			lbs.
O	542.	Debra Dún (O'Callaghan)	48
O	1458.	Bahraich, Oudh (Wood)	47
O	1487.	Kheri, Oudh „	51
C	2782.	Melghát, Berar (Brandis)	—
C	1186.	Ahiri Reserve, Central Provinces (R. Thompson)	—
C	2756.	Moharli Reserve, Central Provinces (Brandis)	48
W	992.	North Kanara (Barratt)	46
C	4221.	Ganjam Forests (Gamble)	52

4. **R. dumetorum**, Lam.; Fl. Br. Ind. iii. 110; Bedd. Fl. Sylv. cxxxii.; Brandis For. Fl. 273; Gamble Darj. List 48; Talbot Bomb. List 108; Trimen Fl. Ceyl. ii. 330. *R. longispina*, DC and *R. nutans*, DC; Kurz For. Fl. ii. 45. *Posoqueria dumetorum*, Willd.; Roxb. Fl. Ind. i. 713. Vern. *Kirkla*, *kokoa*, Kashmir; *Mindla*, *mandkolla*, *arara*, Pb.; *Mainphal*, *manyúl*, *karhar*, *main*, *maini*, *maindal*, *mainhúri*, *manneul*, *arar*, Hind.; *Maidal*, *amuki*, Nep.; *Gundrow*, Mechi; *Gurol*. Rajbanshi; *Panji*, Lepcha; *Pativa*, *potowa*, Uriya; *Madu karray*, *karai*, Tam.; *Manda*, *manga*, Tel.; *Gera*, *galay*, *ghela*, *peralu*, *mindhal*, *monigeli*, Mar.; *Kuay*, *katúl*, Gondi; *Bhita*, Kurku; *Karé*, *karigidda*, Kan.; *Ghatolan*, *karumba*, Merwara; *Gizar*, *ghatu*, Berar; *Man*, *maun*, Monghyr; *Boibindi*, Sonthal; *Saro*, Mal Pahari; *Kukuruman*, Cingh.; *Suthanbaya*, *sutanyet*, *thaminsza*, Burm.

A deciduous thorny shrub or small tree. *Bark* grey. *Wood* white or light brown, compact, hard, close- and even-grained. *Annual rings* marked by a belt without pores. *Pores* very small, evenly distributed. *Medullary rays* fine and very fine, very numerous.

Throughout India, extending north to the Beas; Burma; Ceylon.

Under *R. dumetorum*, as described in Fl. Br. Ind., are perhaps two, possibly more species. The common kind in North India is a small tree with rather large soft leaves and large smooth fruit found in shady forest undergrowth in the deciduous forests of Sál and other trees; this is probably the true *R. dumetorum*. In Bengal, Assam and Burma is a kind with even larger leaves and long thorns and rather small fruit which is probably *R. longispina*, and is found in the moist tropical forests. In South-West India, the most frequent kind is a very thorny shrub with small hard tomentose leaves, and small, ribbed fruit, found in open dry places with other bushy vegetation: this is probably *R. tomentosa*, W. and A. or *R. nutans*, DC. In the Deccan and Carnatic the most common kind has still smaller leaves, hard thorny stems and small fruit, and is found on open dry lands and used for fencing; it is probably *R. floribunda*, DC. But it is difficult to find good botanical characters to separate these kinds, so that their further investigation is needed. I believe that most, if not all, of the wood specimens here described belong to true *R. dumetorum*, the "Mainphal" of the N. Indian Sál forest undergrowth.

Growth moderate, 7 rings per inch of radius, according to the specimens examined; Brandis says slow—that "a section of a tree known to be 65 years old, 4-in. radius, 'hollow inside, showed 54 annual rings on 2 inches of the radius near the circumference." Weight about 54 lbs. per cubic foot. The wood is used for agricultural implements, fences and fuel. The bark of the root and stem and the fruit are used in native medicine, the latter as an emetic. The fruit is also used to poison fish, and when ripe is roasted and eaten.

			lbs.
O	262.	Garhwal (1868)	54
O	1366.	Gonda, Oudh (Wood)	50
O	1461.	Bahraich, Oudh „	62
O	1488.	Kheri, Oudh „	54

		lbs.
O 4798.	Kotri Forest, Saharanpur (Gradon)	54
C 2750.	Moharli Reserve, Central Provinces (young) (Brandis)	45
C 2799.	Melghát, Berar (young) (Brandis)	48
C 4343.	Gullery Forest, Ganjam (Gamble)	61
E 481, 493.	Khookloong Forest, Darjeeling Terai (Manson)	—
E 2386.	Bamunpokri, Darjeeling Terai (Gamble)	—

5. **R. malabarica,** Lamk.; Fl. Br. Ind. iii. 111; Trimen Fl. Ceyl. ii. 331. *R. fragrans,* Kön.; Bedd. Fl. Sylv. cxxxii. *Posoqueria fragrans,* Roxb. Fl. Ind. i. 717. Vern. *Pedalli,* Tel.; *Pudan,* Tam.

An erect thorny shrub. *Bark* brown, rough, ¼ in. thick, deeply cleft in vertical fissures. *Wood* greyish-white, hard, close-grained. *Annual rings* marked by a belt without pores. *Pores* small, uniformly distributed. *Medullary rays* fine and very fine, numerous.

South India, in Orissa, the Circars, Deccan and Carnatic in dry scrub forests; dry region of Ceylon.

This small thorny tree or shrub is characteristic of the dry evergreen scrub forests of the Coromandel coast and adjoining Deccan country; occurring in abundance on laterite hills, and in considerable demand for fencing purposes. It gets browsed down by goats to a low bush, but if left alone for a little while speedily shoots up again and flowers and seeds profusely, so that it is a useful plant in reclothing ruined forest areas and leading the way to a more valuable tree growth, which can come up with its protection and that of several other similarly armed shrubs usually associated with it.

		lbs.
D 4269.	Ballipalle Forest, Cuddapah (Gamble)	42

6. **R. Gardneri,** Thw.; Fl. Br. Ind. iii. 112; Bedd. Fl. Sylv. cxxxii.; Trimen Fl. Ceyl. ii. 331.

A small tree. *Wood* light brown, smooth, close- and even-grained. *Pores* small, uniformly distributed. *Medullary rays* fine, numerous.

Moist regions of Ceylon; Travancore (Bourdillon).

		lbs.
W 4630.	Travancore (Bourdillon)	52

7. **R. Candolleana,** W. and A.; Fl. Br. Ind. iii. 113. *R. deccanensis,* Bedd. Fl. Sylv. cxxxiii. Vern. *Kondamanga,* Tel.

A small tree. *Bark* ½ in. thick, brown, rough. *Wood* light brown, hard, close- and even-grained. *Annual rings* marked by a line without pores. *Pores* very small, numerous, regular. *Medullary rays* very fine and fine, very numerous.

Circars and South Deccan, from the Kistna river to the edge of the Mysore plateau.

This small tree is found on very dry stony hills, chiefly metamorphic, and most usually in company with *Hardwickia binata,* as in the Kistna and Anantapur forests.

		lbs.
D 4149.	Guttikonda Reserve, Kistna (Gamble)	60

25. GARDENIA, Linn.

About eleven species, trees or small trees or shrubs. *G. campanulata,* Roxb. Fl. Ind. i. 710; Fl. Br. Ind. iii. 118; Kurz For. Fl. ii. 40; Vern. *Sethanbaya,* Burm., is a shrub or small tree of the Sikkim Terai and eastwards to Assam, Eastern Bengal, Parasnáth Hill in Behar and the tropical forests of Pegu. *G. sessiliflora,* Wall.; Vern. *Thaminzabyu,* Burm., *G. erythroclada,* Kurz; Vern. *Hmanni,* Burm., *G. dasycarpa,* Kurz, and *G. cuneata,* Br.; Fl. Br. Ind. iii. 118–120; Kurz For. Fl., are small trees of Burma, the first two common in the deciduous forests.

G. florida, Linn., is the common "Gardenia" of gardens cultivated all over India for its sweet-scented flowers (Vern. *Thônzinban,* Burm.)

Wood creamy-white, smooth, close-grained, hard, but cuts easily. *Pores* small to extremely small, evenly distributed, often scanty. *Medullary rays* short, very fine to fine, numerous. Like the species of *Randia*, those of *Gardenia* have the characters of boxwood, and deserve attention as possible substitutes for the cheaper rougher work of engraving, tool-handles, etc.

1. **G. lucida,** Roxb. Fl. Ind. i. 707; Fl. Br. Ind. iii. 115; Bedd. Fl. Sylv. cxxxiv.; Brandis For. Fl. 271; Talbot Bomb. List 108. *G. resinifera*, Roth; Kurz For. Fl. ii. 42. Vern. *Dikamali*, Hind., Guz.; *Konda manga, kokkita, tetta manga*, C.P.; *Papar*, Bijeragogarh; *Karinga, yerra bikki, karaingi, tella-manga*, Tel.; *Kumbi*, Tam.; *Harangi*, Koya.

A small deciduous tree. *Bark* ⅓ in. thick, greenish-grey, exfoliating in irregular flakes. *Wood* yellowish-white, close-grained, hard, no heartwood, no annual rings. *Pores* extremely small. *Medullary rays* very fine, very short.

Central and South India, in the C.P., Deccan, Konkan and Kanara; Chittagong, in deciduous forest.

This plant is perhaps the least common of the four species of the deciduous forests and dry scrub lands of Central India and the Deccan, but it is widely distributed. The wood is useful for turning, it is made into combs. The tree gives a gum resin from wounds in the bark, also from the leaf-buds. This gum is hard, opaque, yellow, greenish or brown, with a strong smell, and is used in the treatment of cutaneous diseases and to keep off flies and worms.

		lbs.
C 1185.	Ahiri Reserve, Central Provinces (R. Thompson)	51

2. **G. gummifera,** Linn. f.; Fl. Br. Ind. iii. 116; Bedd. Fl. Sylv. cxxxiv. 1; Brandis For. Fl. 270; Talbot Bomb. List 108. Vern. *Dikamali, kamarri*, Hind.; *Gurudu*, Uriya; *Chitta matta, chitnityal, gaggaru, manchi bikki*, Tel.; *Chitta bikke, kumbe*, Kan.; *Bururi, burui*, Kól; *Bruru*, Bhumij; *Kurugu, kanga*, Khond.

A small tree. *Bark* greyish-brown, smooth, ¼ in. thick. *Wood* yellowish-white, close-grained, hard. *Pores* very small, numerous, evenly distributed. *Medullary rays* very fine, short, numerous.

Central and South India in the C.P., Chota Nagpore, Orissa, Circars and Deccan in deciduous forest.

This resembles *G. lucida*, and is found in similar places, but affects even drier and hotter localities. The leaf-buds give a transparent bright yellow gum-resin, pleasant to chew, and used like the similar one given by *G. lucida*. I never saw it procured from the bark.

		lbs.
C 3465.	Bandgaon, Singbhúm (Gamble)	—
D 4239.	Nallamalai Hills, Kurnool (Gamble)	54

3. **G. obtusifolia,** Roxb.; Fl. Br. Ind. iii. 116; Kurz For. Fl. ii. 42. Vern. *Yingat*, Burm.

A small deciduous tree with thin, grey bark. *Wood* white, moderately hard, even-grained. *Pores* small. *Medullary rays* moderately broad, and a large number of very fine rays, which are not very distinct.

Burma, in the Eng and other dry forests.

Like the preceding species, this also from the young shoots and leaf-buds yields a yellow pellucid resin.

		lbs.
B 817.	Rangoon Forests, Burma (Ribbentrop)	55

4. **G. latifolia,** Aitbn; Fl. Br. Ind. iii. 116; Roxb. Fl. Ind. i. 706; Bedd. Fl. Sylv. cxxxiv. 1; Brandis For. Fl. 271; Talbot Bomb. List 108; Trimen Fl. Ceyl. ii. 332. Vern. *Pápra, páphar, pepero, ban pindálu*, Hind.; *Pannia bhil, gúngat, bhandara*,

geggar, Gondi; *Phiphar, mali*, Baigas; *Kumbay*, Tam.; *Pedda karinga, pureea, bikki, gaiger, pedda bikki*, Tel.; *Kota-ranga, jantia, dhantia*, Uriya; *Ghogar, gogarli, pandru, papur*, Mar.; *Gogar*, Bhíl; *Popreo*, Koderma; *Popra*, Kharwar; *Papra, papadar*, Kól; *Popro*, Sonthal; *Pempri*, Mal Pahari; *Goteni*, Khond; *Kaka*, Koya; *Kakeda*, Reddi; *Galis*, Cingh.

A small deciduous tree. *Bark* ¼ in. thick, greenish-grey, exfoliating and leaving smooth, conchoidal, rounded depressions. *Wood* light yellowish-brown, close- and even-grained, hard, handsomely mottled, neither warps nor splits. No heartwood. Marked concentric *annual rings*. *Pores* extremely small, numerous. *Medullary rays* fine, short.

Sub-Himalayan tract from the Jumna eastwards (Brandis); Bengal, Central and South India, in deciduous forests in the C.P., Chota Nagpore, Orissa, Circars and Deccan, as far south as Coimbatore; Ceylon, in moist low country.

This species is at once distinguished from its allies *G. lucida* and *G. gummifera*, by its large leaves. I have frequently seen it growing epiphytically in the angles of the branches of large trees like the figs. Brandis says it is found as far west as the Jumna, but I have never heard of it in the Dehra Dún or the Saharanpur Siwaliks. It is strange that Trimen should give it from the *moist* country in Ceylon, for in India it affects *dry* forests. The leaf-buds have gum like the previously mentioned species, but in less quantity.

Growth moderate, 8 rings per inch of radius. Weight 51 lbs. per cubic foot. The wood is easy to work, durable, and is recommended to be tried as a substitute for boxwood; it is likely to be very good for engraving and turning. Combs are made of it.

		lbs.
C 1173.	Ahiri Reserve, C.P. (R. Thompson)	53
C 2733.	Moharli Reserve, C.P. (Brandis)	50
C 4213.	Ganjam Forests (Gamble)	—
D 4241.	Nallamalai Hills, Kurnool (Gamble)	49

5. G. coronaria, Ham.; Fl. Br. Ind. iii. 117; Kurz For. Fl. ii. 43. *G. costata*, Roxb. Fl. Ind. i. 704. Vern. *Yingat*, Burm.

A small deciduous tree. *Bark* smooth, grey. *Wood* light brown, hard, close-grained. *Annual rings* indistinct. *Pores* small. *Medullary rays* fine, short, distinctly visible in the silver-grain as long horizontal plates.

Chittagong and Burma, in mixed forests.

Growth slow, 14 rings per inch of radius. Weight 51 lbs. per cubic foot (Kurz identifies *G. lucida*, No. 72 of Brandis' Burma List of 1862 with this. Weight 49 lbs.) Used for making combs and for turning, but liable to crack.

		lbs.
B 284.	Burma (1867)	50
B 2540.	„ (Brandis, 1862)	52

Nordlinger's Sections, vol. 4 (*G. costata*).

6. G. turgida, Roxb. Fl. Ind. i. 711; Fl. Br. Ind. iii. 118; Bedd. Fl. Sylv. cxxxiv. 1; Brandis For. Fl. 270; Kurz For. Fl. ii. 41; Talbot Bomb. List 108; Trimen Fl. Ceyl. ii. 333. Vern. *Thanella, khúrrúr, khuriari, ghúrga, mhaner*, Hind.; *Thunla*, Kumaon; *Thanera*, Garhwal; *Kirkha*, Kashmir; *Karhár*, Banda; *Panjra, pendra*, Gondi; *Phurpata*, Kurku; *Khurphendra, pendri, phanda, phetra*, Mar.; *Phetrak*, Bhil; *Bamemia*, Uriya; *Kharhar*, Oraon; *Dudúri*, Kól; *Dumki, dondouki*, Sonthal; *Popreo*, Monghyr; *Tellaguma*, Reddi; *Manjúnda, telél, yerra bikki*, Tel.; *Bongeri*, Kan.; *Thaminzani*, Burm.

A small deciduous tree. *Bark* smooth, bluish-grey, ¼ in. thick, compact. *Wood* close-grained, hard, white with a purplish tinge, no heartwood. *Annual rings* marked by a dark line with few pores. *Pores* very small, scanty. *Medullary rays* fine and very fine, very numerous.

Deciduous forests in the greater part of India; sub-Himalayan tract and Lower Himalaya from the Punjab to Nepal, common on dry hills like the Siwaliks, and on outer slopes up to 4000 ft.; Rajputana, the C.P., Chota Nagpore, Orissa, the Circars and Deccan; Berar, Khandésh and south to Dharwar and Kanara; the Shan Hills and the Eng and dry forests of Prome in Burma; dry country of Ceylon, rare.

A conspicuous small tree in the deciduous forests, always on poor soils, laterite and Kunkur, and on rocky hot slopes. As Talbot very rightly remarks, the foliage of young plants differ much from that of mature trees, so much so that some experience is required to identify the former.

Growth slow, 13 rings per inch of radius. Weight, according to R. Thompson, 56·5 lbs. per cubic foot; our specimens give 56 lbs. Wood good, that of the drier regions better and closer grained than that from fairly moist ones.

			lbs.
O	541.	Dehra Dún (O'Callaghan)	—
O	4800.	Kotri Forest, Saharanpur (Gradon)	54
O	1377.	Gonda, Oudh (Wood)	60
O	1463.	Bahraich, Oudh „	—
O	1489.	Kheri, Oudh „	50
C	826.	Bairagarh Reserve, Berar (Drysdale)	54
C	2779.	Melghát, Berar (Brandis)	58
C	1142.	Ahiri Reserve, Central Provinces (R. Thompson)	54
C	3435.	Kumandi Reserve, Palamow (Gamble)	—
C	3779.	Surada Forests, Ganjam (Gamble)	57
W	993.	North Kanara (Barrett)	48

Nos. C 1248 and C 1309 (61 and 63 lbs.), sent from Gumsúr under the name *Gorahadu*, have the same structure as, and probably belong to, this species.

26. PETUNGA, DC.

1. **P. Roxburghii,** DC.; Fl. Br. Ind. iii. 120. *Randia racemosa* and *polysperma*, Roxb. Fl. Ind. i. 525, 527. *Hypobathrum racemosum*, Kurz For. Fl. ii. 51. Vern. *Peetunga*, *jhijir*, *narkeli*, Beng.

An evergreen shrub or small tree up to 15 ft. high. *Bark* light brown, thin, rough with regular narrow close longitudinal clefts. *Wood* white or greyish-white, moderately hard, close- and even-grained. *Pores* small, numerous, regularly distributed. *Medullary rays* fine, close, regular.

Coast forests of the Sundarbans, Chittagong, Arracan and Burma, extending inland to Sylhet; Nicobar Islands.

Heinig says the wood is used for making boxes and native furniture ("Sund. Working Plan").

			lbs.
E	5079.	Sundarbans (Lloyd)	36

27. MORINDOPSIS, Hook. f. *M. capillaris*, Kurz For. Fl. ii. 52; Fl. Br. Ind. iii. 121, is a small evergreen tree, common in the swamp forests of Burma.

28. HYPTIANTHERA, W. and A.

1. **H. stricta,** W. and A.; Fl. Br. Ind. iii. 121; Brandis For. Fl. 274; Gamble Darj. List 48. *Randia stricta*, Roxb. Fl. Ind. i. 526. *Hypobathrum strictum*, Kurz For. Fl. ii. 50.

An evergreen shrub. *Bark* brown, somewhat corky, thin, cleft in long continuous furrows about 2 lines apart. *Wood* brown, moderately hard, close-grained. *Pores* small, evenly distributed. *Medullary rays* of two classes: small ones very fine, very numerous; larger ones few, fine.

Sub-Himalayan forests from Oudh eastwards. Lower Himalaya up to 2000 ft.

Eastern Bengal to Chittagong and Upper Burma, common in the undergrowth of moist forests, on the shady banks of streams and in similar places.

		lbs.
E 3286.	Rinkheong Reserve, Chittagong Hill Tracts (Gamble)	56

29. NARGEDIA, Bedd. *N. macrocarpa*, Bedd. Fl. Sylv. cxxxiv. 2, t. 328; Fl. Br. Ind. iii. 122; Trimen Fl. Ceyl. iii. 334, is a scarce small tree of the moist low country of Ceylon.

30. SCYPHOSTACHYS, Thw. Two Ceylon shrubs, *S. pedunculatus*, Thw., and *S. coffeoides*, Thw.; Fl. Br. Ind. iii. 122; Trimen Fl. Ceyl. ii. 335. The latter is called "Wild Coffee"; Vern. *Wal-kopi*, Cingh. (= wild coffee!?).

31. DIPLOSPORA, DC.

Nine species, two of which are South Indian, two of Ceylon, and the rest of Eastern Bengal or Burma. *D. apiocarpa*, Dalz.; Fl. Br. Ind. iii. 123; Bedd. Fl. Sylv. t. 123; Talbot Bomb. List 109, and *D. sphærocarpa*, Dalz.; Fl. Br. Ind. iii. 123; Bedd. Fl. Sylv. cxxxiv. 3; Talbot Bomb. List 109, are small trees of the higher hills of the Western Ghâts from the Konkan southwards. *D. Dalzellii*, Thw.; Fl. Br. Ind. iii. 123; Trimen Fl. Ceyl. ii. 336 t. 50; Vern. *Vella*, Tam., is a common small tree of the dry low country of Ceylon, with a white, hard, heavy, fine-grained, smooth wood. The rest appear to be very scarce plants.

1. **D. singularis**, Korth.; Fl. Br. Ind. ii. 123; Kurz For. Fl. ii. 50, in part. Vern. *Thittu*, Burm.

A small tree. *Bark* brownish-grey, fibrous, longitudinally fissured. *Wood* white, rough. *Pores* small, evenly distributed. *Medullary rays* numerous, prominent.

Khasia Hills at 3–4000 ft.; Burma and the Andaman Islands.

Neither Fl. Br. Ind. nor Kurz give this tree as growing in the Andamans, but the specimen is Kurz' own, and presumably he satisfied himself of its identity.

		lbs.
B 1998.	Andaman Islands (Kurz, 1866)	36

TRIBE VII. RETINIPHYLLEÆ.

32. SCYPHIPHORA, Gaertn. *S. hydrophyllacea*, Gaertn.; Fl. Br. Ind. iii. 125; Kurz For. Fl. ii. 4; Bedd. Fl. Sylv. cxxxiv. 3; Trimen Fl. Ceyl. ii. 337, is a small tree of Mangrove swamps on the coast of the Carnatic (Wight), Ceylon and the Andaman Islands.

TRIBE VIII. GUETTARDEÆ.

33. GUETTARDA, Linn.

1. **G. speciosa**, Linn.; Fl. Br. Ind. iii. 126; Roxb. Fl. Ind. i. 686; Bedd. Fl. Sylv. cxxxiv. 4; Kurz For. Fl. ii. 37; Trimen Fl. Ceyl. ii. 338. Vern. *Domdomah*, And.; *Panir*, Tam.; *Nil pitcha*, Cingh.

A moderate-sized evergreen tree. *Bark* thin, grey. *Wood* yellow, with a tinge of red. *Pores* small, often in radial lines. *Medullary rays* moderately broad and very fine.

Tidal forests along the shores of the Andaman Islands and Ceylon, often cultivated in gardens near the sea, as at Madras and Colombo. Flowers sweet-scented.

		lbs.
B 1971.	Andaman Islands (Kurz, 1866)	49

34. TIMONIUS, Rumph. *T. Jambosella*, Thw.; Fl. Br. Ind. iii. 127; Bedd. Fl. Sylv. cxxxiv. 4; Trimen Fl. Ceyl. ii. 338 (*Polyphragmon flavescens*, Kurz For. Fl. ii. 38); Vern. *Peddimella, angana*, Cingh., is a small evergreen tree or shrub of the lower hills of Ceylon up to 6000 ft., and of those of the Andaman Islands.

35. DICHILANTHE, Thw. *D. zeylanica*, Thw.; Fl. Br. Ind. iii. 128; Bedd. Fl. Sylv. cxxxiv. 5; Trimen Fl. Ceyl. ii. 339, is a scarce tree of the moist low country o

Ceylon. "The persistent ring-like stipules become coated with resin and form nodosities on the branches" (Trimen).

Tribe IX. ALBERTEÆ.

36. OCTOTROPIS, Bedd. *O. travancorica*, Bedd. Fl. Sylv. cxxxiv. 12, t. 327; Fl. Br. Ind. iii. 131, is a glabrous shrub of the hills of Travancore and Tinnevelly.

Tribe X. VANGUERIEÆ.

37. CANTHIUM, Linn.

About sixteen species, seven of which occur in Ceylon and six in Burma, the rest chiefly in South India. Most of them are small, erect, straggling or climbing shrubs of little or no importance. *C. umbellatum*, Wight; Fl. Br. Ind. iii. 132; Talbot Bomb. List 109 (*C. didymum*, Bedd. Fl. Sylv. t. 221, *Plectronia didyma*, Brandis For. Fl. 276); Vern. *Tupa, arsul*, Mar.; *Yellal*, Kan.; is an evergreen tree of the forests of the Western Ghâts, from the Konkan southwards, ascending the Nilgiris to 4000 ft. It resembles *C. didymum*, but differs in having the flowers in umbels instead of in cymes. *C. neilgherrense*, Wight; Fl. Br. Ind. iii. 133 (*Plectronia neilgherrensis*, Bedd. Fl. Sylv. cxxxiv. 6); Vern. *Nanyúl*, Tam., is a small evergreen tree of the Nilgiri sholas at 5-7000 ft., especially common about Sispara and in Longwood shola at Kotagiri. *C. parvifolium*, Roxb. Fl. Ind. i. 534; Fl. Br. Ind. iii. 135 (*Plectronia parvifolia*, Bth. and Hook. f.; Kurz For. Fl. ii. 36), is a thorny shrub of the Sikkim Himalaya, Behar, the Khasia Hills, Chittagong and the forests around Rangoon in Burma.

Wood hard, close-grained. *Pores* very small, numerous. *Medullary rays* fine and very fine, numerous, regular.

1. **C. didymum,** Roxb. Fl. Ind. i. 535; Fl. Br. Ind. iii. 132; Gamble Darj. List 48; Trimen Fl. Ceyl. ii. 343. *Plectronia didyma*, Bth. and Hook. f.; Kurz For. Fl. ii. 35. Vern. *Tolan, pita koluchia, dhalasingha*, Uriya; *Neckanie, vatchikoran, yerkoli, irambarattkan*, Tam.; *Nalla balasu, nakkani*, Tel.; *Abalu*, Kan.; *Jór*, *Kól; *Pita koloria*, Khond; *Konda, kolinu*, Palkonda; *Atika*, Reddi; *Pana karawu, gal-karanda, pandaru*, Cingh.

An evergreen tree. *Bark* dark grey, smooth but cleft vertically into long narrow strips. *Wood* white (Ceylon) or light brown (India), hard, close- and even-grained. *Annual rings* marked by a dark line with few or no pores. *Pores* very small, numerous, uniformly distributed. *Medullary rays* fine and very fine, numerous.

The greater part of India: in the Sikkim Himalaya at Sitong, 5000 ft.; Khasia and Jaintia Hills; Chota Nagpore, Orissa, the Northern Circars, Deccan and Carnatic, extending to Travancore (the West Coast plant is apparently *C. umbellatum*); Tenasserim in Burma; low country of Ceylon, up to 4000 ft.

A handsome tree with a fine wood, used for agricultural purposes. In Ceylon, its resemblance to boxwood has caused it to be called "Ceylon boxwood."

	lbs.
C 3481. Saranda Forests, Chota Nagpore (Gamble)	—
C 3789. Surada Forests, Ganjam (Gamble)	50
No. 16, Salem Collection	57

2. **C. parviflorum,** Lamk.; Fl. Br. Ind. iii. 136; Roxb. Fl. Ind. i. 534; Talbot Bomb. List 109; Trimen Fl. Ceyl. ii. 346. *Plectronia parviflora*, Bedd. Fl. Sylv. cxxxiv. 5. Vern. *Balasu, balasu kúra, karay*, Tel.; *Kirna*, Mar.

A thorny shrub. *Bark* ½ in. thick, grey, deeply cleft with vertical fissures. *Wood* grey, hard. *Pores* very small, very numerous, evenly distributed. *Medullary rays* fine, numerous, regular.

South India, in the Circars, Deccan and Carnatic; dry places along the Western Coast and in the Mahratta country; dry region of Ceylon.

Like *Randia malabarica*, this is also a shrub of the dry laterite and other coast scrub forests, and the remarks made under that species will also apply to this. The

branches are used for fencing. Beddome says the wood is used in turning and the leaves are eaten in curries.

D 4172. Venkatayapalem Forest, Kistna (Gamble).

3. C. pergracile, Bourdillon in Journ. Bomb. Nat. Hist. Soc. xii. 352, t. iv. Vern. *Palaga*, Mal.

A tall tree. *Bark* light brown, rather rough, ¼ in. thick. *Wood* greyish-brown, moderately hard, even-grained. *Pores* small, numerous. *Medullary rays* fine, distinct, regular.

Evergreen forests of Travancore near Colatoorpolay at 500 ft.

An unarmed tree which reaches 80 ft. in height and 5 ft. in girth. Bourdillon gives W = 48 lbs., P = 870.

	lbs.
W 4598. Travancore (Bourdillon).	52

38. VANGUERIA, Juss. *V. spinosa*, Roxb. Fl. Ind. i. 536; Fl. Br. Ind. iii. 136; Kurz For. Fl. ii. 34; Talbot Bomb. List 110; Gamble Darj. List 48 (*V. pubescens*, Kurz For. Fl. ii. 34); Vern. *Alu*, Bombay; *Semagyi*, Burm., is a large shrub or small tree of Bengal, Western and Southern India and Burma, chiefly in dry forests. *V. edulis*, Vahl is a Madagascar tree sometimes cultivated for its fruit.

Tribe XI. IXOREÆ.

39. IXORA, Linn.

About 34 species, shrubs or small trees, chiefly found in South India, Ceylon or Burma, most of them of small importance. *I. acuminata*, Roxb. Fl. Ind. i. 383; Fl. Br. Ind. iii. 137; Gamble Darj. List 48; Vern. *Churipat*, Nep., is a handsome shrub of the Sikkim Himalaya, Assam, the Khasia Hills and Eastern Bengal with large crowded corymbs of scented white flowers. *I. calycina*, Thw.; Trimen Fl. Ceyl. ii. 347, is a small tree of the hill region of Ceylon at 4–7000 ft. *I. Thwaitesii*, Hook. f.; Trimen Fl. Ceyl. ii. 347, is a common small tree of the low country of Ceylon with a hard close-grained wood. *I. polyantha*, Wight; Talbot Bomb. List 110, is a common shrub of the Western Coast from the Konkan southwards in evergreen forest, said by Beddome to be very beautiful and worthy of garden cultivation. *I. spectabilis*, Wall.; Kurz For. Fl. ii. 22, is an evergreen tree common along streams in Arracan and Burma, with a yellowish-white, heavy, close-grained wood. *I. jucunda*, Thw.; Trimen Fl. Ceyl. ii. 348, is a common small tree of the forests of the moist region of Ceylon up to 4000 ft. *I. undulata*, Roxb. Fl. Ind. i. 385; Gamble Darj. List 49; Vern. *Pari*, Nep.; *Takchir*, Lepcha, is a small tree of the Eastern Himalaya, Assam, the Khasia Hills and Behar. *I. nigricans*, Br.; Kurz For. Fl. ii. 23; Talbot Bomb. List 111; Vern. *Lokhandi*, *kutkura*, Mar., is an evergreen tree or large shrub of the Western Ghâts from the Konkan southwards, and of swamp forests in Burma, also found on Mahendragiri Hill in Ganjam. *I. brunnescens*, Kurz is a tree said by Prain to reach a height of 60 to 80 ft. in the Cocos Island, where it is common, as it also is in the Andamans, Car Nicobar and Batti Malv.

I. coccinea, Linn.; Roxb. Fl. Ind. i. 375; Fl. Br. Ind. iii. 145; Bedd. Fl. Sylv. cxxxiv. 7; Brandis For. Fl. 275; Kurz For. Fl. ii. 26; Talbot Bomb. List 111; Trimen Fl. Ceyl. ii. 348 (*I. Bandhuca*, Roxb. Fl. Ind. i. 376); Vern. *Rangan*, *rajana*, Beng.; *Bakora*, *pendgul*, Mar.; *Vedchi*, Tam.; *Ratambala*, Cingh.; *Pansayeik*, Burm., is a handsome red-flowering shrub common in the moist forests near the Malabar sea-coast, and cultivated in gardens all over India. *I. stricta*, Roxb. Fl. Ind. i. 379; Fl. Br. Ind. iii. 145; Kurz For. Fl. ii. 26, is also a scarlet-flowered cultivated shrub, said by Kurz to be wild in Tenasserim.

Wood brownish, hard, close-grained. *Pores* small. *Medullary rays* very fine, numerous, regular.

1. I. Notoniana, Wall.; Fl. Br. Ind. iii. 139. Vern. *Kalilambili*, Tam.; *Irumbaripi*, Travancore Hills.

A large evergreen shrub or small tree. *Bark* ¼ in. thick, brown,

rough. *Wood* light yellowish-brown to red, hard, close-grained. *Pores* small, very scanty. *Medullary rays* very fine to fine and almost to moderately broad, numerous. Frequent small medullary patches.

Sholas of the Nilgiri and Pulney Hills, 5-6000 ft.; hills of Travancore.

		lbs.
W 3740.	Coonoor, Nilgiris, 6000 ft. (Gamble)	57
W 4628.	Travancore (Bourdillon).	58

2. I. **parviflora**, Vahl.; Fl. Br. Ind. iii. 142; Roxb. Fl. Ind. i. 383; Brandis For. Fl. 275; Bedd. Fl. Sylv. t. 222; Kurz For. Fl. ii. 21; Talbot Bomb. List 110; Trimen Fl. Ceyl. ii. 348. The Torch tree. Vern. *Kota gandhal*, Hind.; *Rangan*, Beng.; *Kauria*, Meywar; *Kúrat, lokandi, kura*, Mar.; *Disti*, Gondi; *Hota*, Koderma; *Pété*, Kól; *Nesomnú, merommet*, Sonthal; *Konthra*, Mal Pahari; *Kilakerwa, tellu kurwan*, Uriya; *Tutu, kuruperi*, Khond; *Koringi*, Palkonda; *Piré*, Koya; *Gedda chida*, Reddi; *Kori*, Gondi; *Hennu, gorri, korgi*, Kan.; *Shulundu kora, karankutti, painkuray*, Tam.; *Karipal, kachipadel, tadda pallu, goripi, gurupu, gori, gorivi, korivi*, Tel.; *Maha ratambala*, Cingh.

An evergreen shrub or small tree. *Bark* ¼ in. thick, dark brown, exfoliating in irregular rounded scales. *Wood* light brown to reddish-brown, smooth, very hard, close-grained. *Pores* small, evenly distributed. *Medullary rays* very fine, very numerous, regular.

Deciduous forests throughout the Peninsula of India, not found north of the Ganges; dry forests of the Prome District of Burma; dry low country of Ceylon.

A handsome and conspicuous fragrant shrub with a useful wood which would do for turning and engraving. Beddome says the wood is used for furniture and building purposes, but it is hardly large enough. Skinner, No. 84, gives W = 66 lbs., P = 717; the specimen here described gives 57 lbs. only. Growth moderate, 10 rings per inch of radius. The green branches are used for torches.

		lbs.
C 1156.	Ahiri Reserve, Central Provinces (R. Thompson) . . .	57
C 3464.	Saranda Forests, Chota Nagpore (Gamble)	—

40. PAVETTA, Linn.

About nine or ten species, shrubs or small trees, very nearly allied to *Ixora*. *P. subcapitata*, Hook. f.; Fl. Br. Ind. iii. 150, is a shrub of the Jaintia Hills in Assam. *P. hispidula*, W. and A.; Fl. Br. Ind. iii. 151; Talbot Bomb. List 111; Trimen Fl. Ceyl. ii. 350 (*P. Siphonantha*, Dalz. and *P. tomentosa*, Roxb. (in part); Bedd. Fl. Sylv. cxxxiv. 8), is a large shrub of the forests of the Western Ghâts, the S. Indian hill ranges and the moist region of Ceylon. *P. naucleiflora*, Wall.; Fl. Br. Ind. iii. 152 (*Ixora naucleiflora*, Kurz For. Fl. ii. 19), is a shrub or small tree of the Eastern Himalaya, Sylhet and Tenasserim. *P. Brunonis*, Wall. and *P. Wightii*, Hook. f. are shrubs of the sholas of the Nilgiri Hills. *P. involucrata*, Thw. and *P. Gleniei*, Thw.; Trimen Fl. Ceyl. ii. 351; Vern. *Vetpavaddai*, Tam., are large shrubs of Ceylon, the former found in the hill forests, the latter common in the dry region.

Wood hard, usually white, even-grained. *Pores* extremely small to very small, scanty. *Medullary rays* numerous, short, fine and very fine.

1. **P. indica**, Linn.; Fl. Br. Ind. iii. 150; Bedd. Fl. Sylv. cxxxiv. 7; Brandis For. Fl. 275; Gamble Darj. List 49; Talbot Bomb. List 111; Trimen Fl. Ceyl. ii. 349. *P. tomentosa*, Sm.; Bedd. Fl. Sylv. cxxxiv. 7; Brandis For. Fl. 275. *Ixora Pavetta*, Roxb. Fl. Ind. i. 385; Kurz For. Fl. ii. 18. *I. tomentosa*, Roxb. Fl. Ind. i. 386; Kurz For. Fl. ii. 18. Vern. *Angari*, Dehra Dún; *Padera, puldu, túmria*, Kumaon; *Pandia*, Garhwal; *Dhúrsú*, Dotiál; *Júi*, Beng.; *Sundók*, Lepcha; *Kotapengu*, Uriya; *Sikriba, sikerúp*, Kól; *Burhi*, Kharwar; *Parpiri*, Koya; *Papadi*, Reddi; *Papiri, papatta, nam-papúta*, Tel.; *Pavaddai*, Tam.; *Pawatta*, Cingh.

A large shrub. *Bark* thin, smooth, brownish-grey. *Wood* white to light brown, hard, close-grained. *Pores* very small, scanty. *Medullary rays* short, numerous, fine and very fine.

Throughout India, chiefly in forest undergrowth in the deciduous forests, and usually in ravines; Burma, the Andaman Islands and Ceylon, very variable.

		lbs.
O 3086.	Gonda, Oudh	59
O 4816.	Dholkot Forest, Dehra Dún (Gamble)	47

2. **P. breviflora,** DC; Fl. Br. Ind. iii. 151; Bedd. Fl. Sylv. cxxxiv. 7.

A large shrub. *Bark* greyish-white, smooth, very thin. *Wood* white, hard, close- and even-grained. *Pores* extremely small, scanty, uniformly distributed. *Medullary rays* fine and very fine, numerous, short. *Annual rings* marked by a faint line.

Higher sholas of the Nilgiris, at 6–8000 ft.

		lbs.
W 4037.	Lovedale, Ootacamund, 7000 ft. (Gamble)	51

41. COFFEA, Linn.

Six species. *C. bengalensis*, Roxb. Fl. Ind. i. 540; Fl. Br. Ind. iii. 153; Brandis For. Fl. 277; Bedd. Fl. Sylv. cxxxiv. 8; Kurz For. Fl. ii. 28; Gamble Darj. List 49; Vern. *Kath-jahi*, Hind.; *Kundrudi*, Mechi, is a small shrub common in the undergrowth of moist forests in the sub-Himalaya from Dehra Dún eastwards, Central and South India and Burma, with a profusion of white flowers. *C. Wightiana*, W. and A. and *C. travancorensis*, W. and A. are small shrubs of S. India and Ceylon; *C. fragrans*, Wall. is found in Burma; while *C. khasiana*, Hook. f. and *C. Jenkinsii*, Hook. f. are found in the Khasia Hills. *Coffea liberica*, Hiern, the "Liberian coffee," is now very largely grown in India, and in Java has to a considerable extent replaced the Arabian species.

1. **C. arabica,** Linn.; Roxb. Fl. Ind. i. 539; Bedd. Fl. Sylv. cxxxiv. 8; Brandis For. Fl. 276; Kurz For. Fl. ii. 27; Gamble Darj. List 49. Coffee. Vern. *Bun* (the berry), *kahwa* (the same roasted and ground).

A shrub with thin grey bark. *Wood* white, moderately hard, close-grained. *Pores* very fine and extremely fine. *Medullary rays* very fine, numerous, short.

Indigenous in Abyssinia and the Soudan, cultivated since the fifteenth century in Arabia and introduced thence to India. It has been cultivated in many parts of India, but on a large scale only in Mysore, Coorg, the Western Gháts, and formerly in Ceylon. It is occasionally found running wild in the forests.

W 3150. Coorg (20 to 25 years old).
Nordlinger's *Sections*, vol. 2.

TRIBE XII. MORINDEÆ.

42. MORINDA, Linn.

Six or seven species, trees, shrubs or climbers. *M. citrifolia*, Linn.; Fl. Br. Ind. iii. 155; Roxb. Fl. Ind. i. 541; Kurz For. Fl. ii. 60; Talbot Bomb. List 112; Trimen Fl. Ceyl. ii. 354; Vern. *Barachúnd*, Beng.; *Aavl*, *bartundi*, Bombay; *Aak*, Mar.; *Ainshi*, Kan.; *Nuna*, Tam.; *Ahu*, Cingh.; *Nyawgyi*, *niba*, Burm., is a small tree found on the coasts of India, Burma and Ceylon, often cultivated. The roots give, in common with those of other species, an important dye. *M. angustifolia*, Roxb. Fl. Ind. i. 547; Fl. Br. Ind. iii. 156; Brandis For. Fl. 278; Kurz For. Fl. ii. 61; Gamble Darj. List 49; Vern. *Dala hardi*, Nep.; *Haldi*, Lepcha; *Kchai tun*, Phekial; *Chenung*, *chengrúng*, Garo; *Yèyo*, Burm., is an evergreen tree of the Eastern Himalaya up to 6000 ft., Assam, Eastern Bengal and Tenasserim, its root also giving a dye. *M. persicæfolia*, Ham.; Vern. *Nibasegale*, Burm., is a shrub of Eastern Bengal and Burma. *M. umbellata*, Linn. is a common climbing shrub of South India and Ceylon, rising in the hills to 4000 ft.

1. **M. tinctoria,** Roxb. Fl. Ind. i. 543; Fl. Br. Ind. iii. 156; Talbot Bomb. List 112; Trimen Fl. Ceyl. ii. 354. *M. exserta*, Roxb.; Brandis For. Fl. 277; Kurz For. Fl. ii. 59. *M. citrifolia*, Linn.; Bedd. Fl. Sylv. t. 220; Gamble Darj. List 49. Vern. *Al*,

ach, Hind.; *Alleri, alládi*, Panch Mehals; *Hardi*, Nep.; *Nuna, manjanatti, manchavana*, Tam.; *Ainshi*, Konkan; *Achu*, Uriya; *Ali*, Gondi; *Aschu, atzu*, Khond; *Chekka*, Reddi; *Ahu*, Cingh.; *Nyaw, niba*, Burm.

A moderate-sized deciduous tree. *Bark* corky, brittle, brown or grey, with numerous deep, longitudinal cracks. *Wood* red, often yellow with red streaks, moderately hard, close-grained. *Annual rings* faintly marked. *Pores* small, scanty, in radial or oblique groups, rather distant from each other. *Medullary rays* fine and moderately broad, rather distant.

Throughout the greater part of India south of the Gangetic plain and in Bengal, Assam and Burma, usually in dry forests; dry region of Ceylon.

I have adopted here, what appears to be the conclusion arrived at by most writers, the view that *M. citrifolia* is a well-marked distinct plant found only on the coast, and that the forms of the common *Morinda* of the deciduous forests belong to one variable species, *M. tinctoria*.

Growth moderate, 7 rings per inch of radius. Weight, according to Skinner, No. 97 (*M. citrifolia*), 30 lbs. per cubic foot; Wallich 29 lbs.; the specimens here enumerated give 41 lbs. Skinner gives P = 410. The wood is handsome and durable: Wallich's specimen (No. B 2690), cut in Burma in 1828, was quite sound when cut up after 50 years in Calcutta. It is used for plates and dishes. The bark of the root is largely used for dyeing red and yellow, and is the dye used for red thread for carpets, turbans, etc. On the subject of the "*Al*" dye and of the varieties or species of *Morinda* that give it, reference can also be made to Agric. Ledger, No. 9 (1895) by Dr. G. Watt and others.

		lbs.
C 1130.	Ahiri Reserve, Central Provinces (R. Thompson)	36
C 3535.	Khurdha Forests, Orissa (Gamble)	40
C 3792.	Kurcholy Forests, Ganjam ,, ...	42
C 1246, 1307.	Gumsúr, Madras (Dampier)	47 and 42
B 2690.	Tavoy (Wallich, 1828)	41
No. 34,	Salem Collection	40

43. RENNELLIA, Korthals. *R. speciosa*, Hook. f.; Fl. Br. Ind. iii. 158 (*Morinda speciosa*, Kurz For. Fl. ii. 62), is a stout evergreen climbing shrub of Tenasserim.

44. DAMNACANTHUS, Gaertn. *D. indicus*, Gaertn. f.; Fl. Br. Ind. iii. 158, is a rigid thorny shrub, common in China, and believed to have been found wild by Griffith in the Mishmi Hills.

45. PRISMATOMERIS, Thw. *P. albidiflora*, Thw.; Fl. Br. Ind. iii. 159; Bedd. Fl. Sylv. cxxxiv. 10; Trimen Fl. Ceyl. ii. 355 (*Coffea tetrandra*, Roxb. Fl. Ind. i. 538; Kurz For. Fl. ii. 28), is an evergreen small tree or shrub of the Khasia Hills, Chittagong, the Martaban Hills, the Andaman Islands and the moist region of Ceylon, up to 4000 ft.

46. GYNOCHTHODES, Blume. *G. macrophylla*, Kurz; Fl. Br. Ind. iii. 160; Kurz For. Fl. ii. 33, is an evergreen scandent shrub of the coast of the Andaman Islands.

Tribe XIII. PSYCHOTRIEÆ.

47. PSYCHOTRIA, Linn.

A large genus containing over 40 species, mostly small trees or shrubs of the undergrowth of the damper hill-forests, especially in South India and Ceylon. An idea of the distribution of the genus may be gained by recording that Trimen describes 13 species, of which 9 are endemic, in Ceylon. Talbot gives 6 species from the Bombay Ghâts, 3 of which are newly described. Kurz mentions 13 species as occurring in Chittagong, Burma and the Andaman and Nicobar Islands. About 16 are found in South India. They are mostly evergreen shrubs, and prefer the forest undergrowth in the shade of larger trees. Several species are conspicuous in the Nilgiri sholas, but only two reach as far as the Sikkim Himalaya. They are of little economic importance, but sylviculturally they help largely, with the species of Hedyotis, *Lasianthus* and *Saprosma*,

of a few other shrubs and of the many species of *Strobilanthes* with which they associate, to keep the soil moist and increase the humus. It is unnecessary to do more than mention a few of the more common ones in addition to those of which the wood is described. *P. erratica*, Hook. f. and *P. calocarpa*, Kurz are found in the Eastern Himalaya and Assam. *P. fulva*, Ham. is a large species of the Assam Valley, the Khasia Hills and Cachar. *P. Thwaitesii*, Hook. f. and *P. truncata*, Wall. are common species in the forests of the Western Gháts, the former extending to Ceylon.

Wood moderately hard, close-grained. *Pores* extremely small to very small, usually scanty. *Medullary rays* fine, numerous.

1. **P. congesta,** W. and A.; Fl. Br. Ind. iii. 162.

A shrub or small tree. *Bark* light brown, thin, smooth. *Wood* white or greyish-white, moderately hard, close-grained. *Pores* extremely small, scanty. *Medullary rays* fine to moderately broad, very numerous.

Sholas of the Nilgiri and Pulney Hills at 7–8000 ft., common on Doddabetta.

W 4046. Lovedale, Ootacamund, 7000 ft. (Gamble).
W 3813. Avalanché, Nilgiris, 7000 ft. (Gamble).

2. **P. elongata,** Wight; Fl. Br. Ind. iii. 163; Trimen Fl. Ceyl. ii. 359.

A large shrub. *Bark* brown, thin, smooth. *Wood* white or reddish-white, hard, close-grained. *Pores* extremely small. *Medullary rays* very fine, very numerous, wavy.

Nilgiri and Shivagiri Hills of S. India at 5–7000 ft.; hill region of Ceylon.

W 3992. Kolakambé, Nilgiris, 5000 ft.

3. **P. bisulcata,** W. and A.; Fl. Br. Ind. iii. 171; Trimen Fl. Ceyl. ii. 362.

A large shrub. *Bark* light brown, thin, corky, cleft into somewhat regular, vertical, elongated plates. *Wood* grey, moderately hard. *Pores* very small, evenly distributed, often somewhat concentrically. *Medullary rays* very fine, wavy, short.

Sholas of the Nilgiri Hills above 4000 ft.; hill region of Ceylon; a common species.

W 3812. Avalanché, Nilgiris, 7500 ft. (Gamble).

48. CHASALIA, Comms. *C. curviflora*, Thw.; Fl. Br. Ind. iii. 176; Kurz For. Fl. ii. 14; Gamble Darj. List 49; Talbot Bomb. List 113; Trimen Fl. Ceyl. ii. 362; Vern. *Antabi*, Lepcha, is a common and widely distributed small shrub of the Sikkim Himalaya, Assam, Eastern Bengal, Burma, Western and South India and Ceylon, remarkable for its curved corolla.

49. LASIANTHUS, Jack.

Another large genus of shrubs which, like *Psychotria* and *Saprosma*, are found in the undergrowth of moist forests, under bigger trees. There are about 40 species altogether: 9 are found in Ceylon, 12 in Southern and Western India, 9 in Burma, 4 in the Andaman Islands, 11 in Assam and Eastern Bengal, 1 in the Circar mountains, and 2 in the Sikkim Himalaya. They have distichous leaves with parallel nerves and reticulate venation. Economically, they have no particular use; sylviculturally they are useful in keeping the soil of the forest moist and cool and increasing the humus. *L. Biermanni*, King; Fl. Br. Ind. iii. 190; Gamble Darj. List 49; Vern. *Deomuk*, Lepcha, is a common shrub about Darjeeling at 6–9000 ft., with bright turquoise-blue berries. *L. cyanocarpus*, Jack; *L. Wallichii*, Wight; *L. lucidus*, Bl. and *L. Hookeri*, Clarke, are found in the Khasia Hills or adjacent parts of Assam, the first three extending also to Burma. In the Nilgiris the common species are *L. acuminatus*, Wight, and *L. capitulatus*, Wight, besides *L. venulosus*, Wight, whose wood is here described, the commonest of all. *L. truncatus*, Bedd. is found on Mahendragiri Hill in Ganjam. *L. strigosus*, Wight; Trimen Fl. Ceyl. ii. 367; Vern. *Wal-kopi*, Cingh., is the common species, often gregarious in the moist country of

Ceylon up to 5000 ft. *L. sessilis*, Talbot Bomb. List 114, is a large shrub nearly allied to this last, and found in the evergreen forests of North Kanara.

1. **L. venulosus**, Wight; Fl. Br. Ind. iii. 190.

A large shrub. *Bark* light brown, rough, with small regular corky protuberances. *Wood* grey, hard, close-grained. *Pores* extremely small, evenly distributed. *Medullary rays* very fine, regular, close. The transverse section shows many concentric bands which may be annual rings, but if so, prove the growth to be very slow.

Sholas of the Nilgiri Hills at 5–8000 ft., very common.

		lbs.
W 4035.	Lamb's Rock shola, Coonoor, 5500 ft. (Gamble) . . .	48
W 4099.	Lovedale, Ootacamund, 7000 ft. „ . . .	47

50. SAPROSMA, Blume.

Six species, all shrubs whose leaves when bruised give an unpleasant odour. They also belong to the undergrowth of the moist forests. *S. indicum*, Dalz.; Fl. Br. Ind. iii. 192; Talbot Bomb. List 114; Trimen Fl. Ceyl. ii. 368, is a shrub of the evergreen forests of the Western Ghâts from the Konkan southwards, ascending to 4000 ft., also found in Ceylon. *S. fragrans*, Bedd. Fl. Sylv. cxxxiv. 11, is found on the Nilgiri Hills and the hills of Tinnevelly. *S. consimile*, Kurz For. Fl. ii. 29, is found in the Khasia Hills and in the drier hill forests of Martaban at 3–5000 ft. *S. ternatum*, Hook. f.; Kurz For. Fl. ii. 29, is found in the Eastern Himalaya, the Khasia Hills, Chittagong, Burma and the Andaman Islands.

1. **S. ceylanicum**, Bedd. Fl. Sylv. cxxxiv. 12; Fl. Br. Ind. iii. 193; Trimen Fl. Ceyl. ii. 369.

A shrub or small tree. *Bark* grey, thin, smooth. *Wood* white, moderately hard. *Pores* small, scattered. *Medullary rays* fine, numerous, regular, often wavy.

Hills of South India and Ceylon, above 3000 ft.

A shrub of the forest undergrowth, with bright blue berries, giving an unpleasant odour when bruised, as do the leaves.

W 3814. Avalanché, Nilgiris, 7000 ft. (Gamble).

51. HYDNOPHYTUM, Jack. *H. formicarium*, Jack; Fl. Br. Ind. iii. 194; Kurz For. Fl. ii. 8, is an evergreen small epiphytic shrub, frequent on trees in the mangrove swamps of South Andaman, and having a thick tuber-like trunk, the cavities in which are used as a home by species of black ant.

Tribe XIV. PÆDERIEÆ.

52. PÆDERIA, Linn. About seven species, small climbing shrubs of the Eastern Himalaya, Eastern Bengal and Burma. *P. fœtida*, Linn.; Fl. Br. Ind. iii. 195; Roxb. Fl. Ind. i. 683; Gamble Darj. List 49; Vern. *Gandha badhuli*, Beng.; *Gundali*, Hind.; *Padebiri*, Nep.; *Takpœdrik*, Lepcha, is a thin climber of Bengal and Burma, with handsome flowers and fruit, which latter is said to be used in Sikkim by Lepchas and Nepalese to prevent toothache.

53. HAMILTONIA, Roxb.

1. **H. suaveolens**, Roxb. Fl. Ind. i. 554; Fl. Br. Ind. iii. 197; Brandis For. Fl. 278; Bedd. Fl. Sylv. cxxxiv. 12; Gamble Darj. List 49; Talbot Bomb. List 115; Vern. *Muskei, kantálu, fisauni*, Chenat; *Niggi, tulenni phúl, gohinla*, Ravi; *Kaneru, pudári*, Beas; *Phillu, kutaichu*, Sutlej; *Páderai*, Jaunsar; *Padera*, Kumaon; *Bainchampa*, Nep.; *Gidesa*, Bombay.

A large shrub. *Bark* grey, shining, peeling off in short papery

Bark thin, with longitudinal fissures. *Wood* grey, hard. *Pores* very small; in short radial lines between the distant, fine and moderately broad *medullary rays*.

All hill regions of India, Burma and Ceylon, above 3000 ft.

A gregarious shrub, coming up on old cultivated lands at 3–6000 ft. in the Sikkim Hills, and often covering large tracts of land until killed down by the tree growth which succeeds it. It is probably the *Nagdana* of Cachar, said by Mr. Brownlow to be one of the plants on which the *Attacus Atlas* silkworm is fed. Its ashes are considered to give a good manure.

E 2857. Tukdah Forest, Darjeeling, 5000 ft. (Gamble).

8. SENECIO, Linn.

A large genus of showy-flowered plants, mostly herbaceous, and resembling the well-known "groundsel" and "ragwort" of Europe, some of them becoming shrubs or climbers. The chief species are that of which the wood has been described, and its allies, *S. araneosus*, DC and *S. scandens*, Don, found in the Himalaya and other hill regions of India.

1. **S. corymbosus**, Wall.; Fl. Br. Ind. iii. 351; Trimen Fl. Ceyl. iii. 50.

A large climbing shrub. *Bark* light brown, thick, corky, the cork thicker on the younger stems, inner layers dark. *Wood* yellow, soft. *Pores* large, scanty, in radial lines between the broad *medullary rays*.

Hills of the N. Circars, Nilgiris and Ceylon, above 4000 ft.

C 3787. Mahendragiri, Ganjam, 4500 ft. (Gamble).
W 3796. Ootacamund, Nilgiris, 7500 ft. „

9. LEUCOMERIS, Don.

Two species. *L. decora*, Kurz For. Fl. ii. 78; Fl. Br. Ind. iii. 387, is a small deciduous tree of the Eng forests of the Prome District, and of the Shan Hills at 2–5000 ft.

1. **L. spectabilis**, Don; Fl. Br. Ind. iii. 386. Vern. *Kapashi*, Kumaon; *Pandu*, Garhwal; *Phusiári*, *phusara*, Dehra Dún.

A small tree. *Bark* ½ in. thick, brown, corky. *Wood* light brown, soft. *Pores* moderate-sized, single or subdivided into 2 to 5 partitions or in groups of 1 to 5, in patches of loose tissue. *Medullary rays* moderately broad, giving a good silver-grain.

Outer slopes of the Western Himalaya from Sirmúr to Nepal, up to 4000 ft. in deciduous forest: common below Mussoorie and Chakrata.

	lbs.
H 4459. Paled Forest, Malkot, Dehra Dún, 3500 ft. (Gamble) . .	32

ORDER LXI. GOODENOVIEÆ.

1. SCÆVOLA, Linn. *S. Koenigii*, Vahl; Fl. Br. Ind. iii. 421; Kurz For. Fl. ii. 84; Talbot Bomb. List 116; Trimen Fl. Ceyl. iii. 54 (*S. Taccada*, Roxb. Fl. Ind. i. 527); Vern. *Bhadrak*, Mar.; *Pinlètan*, Burm.; *Takkada*, Cingh., is a large evergreen shrub of tidal forests all round India, from Bombay to Ceylon, and on both sides of the Bay of Bengal. It has stout branches and large leaves; the pith is soft and spongy, and the wood coarse, milky and fibrous. *S. Plumieri*, Vahl; Trimen Fl. Ceyl. iii. 55 (*S. Lobelia*, Linn.; Fl. Br. Ind. iii. 421; Talbot Bomb. List 116), is a similar shrub with smaller leaves, found in the coast forests of Sind, Malabar and the dry districts of Ceylon, especially noticeable at the mouths of the Indus near Karachi.

ORDER LXII. VACCINIACEÆ.

An Order of small trees or shrubs, erect or epiphytic, of the mountains of the Eastern Himalaya, Eastern Bengal, Burma, South India and Ceylon. There are four genera belonging to two Tribes, viz.—

Tribe I. Thibaudieæ	. . . . . .	Agapetes, Pentapterygium.
„ II. Euvaccinieæ	. . . . . .	Vaccinium, Corallobotrys.

1. AGAPETES, D. Don. A genus of shrubs, often epiphytic. There are about 24 species, and many of them have stems thickened at the base. They chiefly occur in the Khasia Hills and Assam, extending westwards to the Sikkim Himalaya, and east and south to Burma. None of them are of any economic or sylvicultural importance.

2. PENTAPTERYGIUM, Klotzsch. Also a genus containing about six species of usually epiphytic, bulbous-stemmed shrubs of the Eastern Himalaya and Khasia Hills. *P. serpens*, Klotzsch; Fl. Br. Ind. iii. 449; Gamble Darj. List 50; Vern. *Kali harchu*, Nep.; *Keembooten*, Lepcha, is a common and conspicuous, usually epiphytic shrub of the Sikkim Himalaya, having crimson flowers with black markings.

3. VACCINIUM, Linn.

About 17 species, small trees or shrubs, some of the latter quite small, and often epiphytic. Except two small trees, whose woods are here described, all the species are from the Eastern Himalaya, Assam and Burma. *V. Dunalianum*, Wight; Fl. Br. Ind. iii. 453; Gamble Darj. List 50, is a shrub of the Eastern Himalaya and Khasia Hills, not uncommon. *V. bancanum*, Miq.; Fl. Br. Ind. iii. 454 (*V. exaristatum*, Kurz For. Fl. ii. 91), is a large evergreen shrub of the drier hill forests of Martaban at 5–6000 ft. To this genus belong the Whortleberry or Bilberry (*V. Myrtillus*, Linn.) and Cranberry (*V. Oxycoccos*, Linn.) of Europe, and other similar small shrubs.

Pores small to extremely small. *Medullary rays* moderately broad to broad. *Wood* smooth, cuts well, and has a good silver-grain.

1. **V. serratum,** Wight; Fl. Br. Ind. iii. 452; Gamble Darj. List 50. *Ceratostemma vacciniaceum*, Roxb. Fl. Ind. ii. 412. Vern. *Charu*, Nep.

A shrub, often epiphytic. *Bark* brown with white lenticels. *Wood* white. *Pores* extremely small. *Medullary rays* broad, wavy.

Hill forests of the Eastern Himalaya in Sikkim and Bhutan, also of the Khasia Hills at 4–8000 ft.

E 3296. Babookhola, Darjeeling, 4000 ft. (Gamble).

2. **V. nilgherrense,** Wight; Fl. Br. Ind. iii. 454; Bedd. Fl. Sylv. cxxxvi.

A large shrub. *Bark* thin, dark greyish-brown, cleft vertically and horizontally into small scales. *Wood* reddish-brown, moderately hard. *Pores* very small, very numerous. *Medullary rays* moderately broad, wavy.

Sholas of the Nilgiri Hills, especially on the east side in dry places at 4–7000 ft.; Anamalai and Pulney Hills, etc.

W 3757. Coonoor, Nilgiris, 6000 ft. (Gamble).

3. **V. Leschenaultii,** Wight; Fl. Br. Ind. iii. 455; Bedd. Fl. Sylv. t. 277; Trimen Fl. Ceyl. 61. *V. rotundifolium*, Bedd. Fl. Sylv. cxxxvi. Vern. *Anduván*, *kilar*, Badaga; *Boralu*, Cingh.

A small tree. *Bark* thin, greyish-brown, tessellated in small somewhat rectangular scales. *Wood* light reddish-brown, moderately hard. *Pores* small, rather scanty, inconspicuous, single or in small groups. *Medullary rays* broad, shining, somewhat wavy, making a handsome silver-grain on a radial section.

Hills of South India and Ceylon; in the Nilgiris it is common in dry sholas at the eastern side at 4–7000 ft.

An ornamental little tree with pink flowers and a nice wood which might be useful for carving and turning, but requires to be well-seasoned or it will split. The fruit is edible and makes good tarts.

		lbs.
W 3737.	Coonoor, Nilgiris, 6000 ft. (Gamble)	42
W 3918.	Aramby, Ootacamund, 7000 ft. (Gamble)	48

4. CORALLOBOTRYS, Hook. f. *C. acuminata*, Hook. f.; Fl. Br. Ind. iii. 455 (*Vaccinium acuminatum*, Kurz For. Fl. ii. 90), is an epiphytic shrub of the Khasia Hills at 3–4000 ft., and of the hills of Burma.

ORDER LXIII. **ERICACEÆ.**

Contains eight genera of usually handsome-flowered Indian trees or shrubs; some of these, however, especially the genera *Cassiope* and *Diplarche*, contain merely small prostrate heath-like plants, found in the Inner Himalaya. The genera belong to two Tribes, viz.—

Tribe I. Andromedeæ	Gaultheria, Diplycosia, Cassiope, Leucothoe, Pieris, Enkianthus.
„ II. Rhodoreæ	Diplarche, Rhododendron.

An Order of handsome plants, all of them of hill regions and cool climates. The true heaths are found chiefly in Europe and in S. Africa. In England the "Bell-heather" with purple flowers is *E. cinerea*, Linn.; in the Mediterranean region the largest species, the one whose roots are used to make "briar," or "bruyère," pipes, is *E. arborea*, Linn. The common Heath or Ling is *Calluna vulgaris*, Salisb. The Arbutus, or Strawberry tree, *A. Unedo*, Linn., is sometimes cultivated in Indian Hill Gardens.

Bark generally thin. *Wood* compact, smooth, even-grained, cuts easily. *Pores* uniform and uniformly distributed, small or very small, numerous. *Annual rings* generally marked by belt of porous wood. *Medullary rays* short, often moderately broad, usually dark-coloured.

1. GAULTHERIA, Linn.

Six species, of which two are merely small procumbent wiry shrubs, and two others are found only in very high regions in the Sikkim Himalaya, viz. *G. pyrolæfolia*, Hook. f. and *G. Hookeri*, Clarke.

1. G. fragrantissima, Wall.; Fl. Br. Ind. iii. 457; Bedd. Fl. Sylv. cxxxvi.; Gamble Darj. List 50; Trimen Fl. Ceyl. iii. 62. *G. punctata*, Bl.; Kurz For. Fl. ii. 92. Vern. *Wel-kapúru*, Cingh.

A large shrub. *Bark* light brown, very thin, shining. *Wood* light brown, moderately hard. *Pores* very small, very numerous, uniformly distributed, inconspicuous. *Medullary rays* fine to moderately broad, short, numerous, giving a good silver-grain.

Eastern Himalaya from Nepal to Bhutan at 6–8000 ft.; Khasia Hills; drier hill forests of Martaban at 6–7000 ft.; hills of South India, very common on the Nilgiris; higher mountain zone of Ceylon.

A common shrub: in the Nilgiris and other mountain ranges of South India and in Ceylon it is gregarious on dry hill-sides, and remarkable for its bright turquoise-blue berries, which are eaten by Badagas. The leaves give an essential oil like that of the Canadian wintergreen. It is an excellent antiseptic. Salicylic acid and carbolic acid can also be made from it (on this oil, see "Pharmacographia Indica," vol. ii. 325).

		lbs.
W 3769, 3807.	Sispara, Nilgiris, 6700 ft. (Gamble)	43 and 40

2. C. Griffithiana, Wight; Fl. Br. Ind. iii. 458; Gamble Darj. List 50.

A shrub. *Bark* light brown, peeling off in papery layers. *Wood* greyish-white, moderately hard. *Pores* extremely small, numerous, inconspicuous. *Medullary rays* fine, scanty. Many medullary spots.

Eastern Himalaya and the Khasia Hills, above 5000 ft.

E 3394. Jalapahar, Darjeeling, 7500 ft. (Gamble).

2. DIPLYCOSIA, Blume. Two species, shrubs of the Eastern Himalaya, in Bhutan and the Daphla Hills.

3. CASSIOPE, D. Don. Two small heather-like shrubs, the most common being *C. fastigiata*, D. Don; Fl. Br. Ind. iii. 459; Vern. *Chota lewar*, Beas; *Seeru*, Chor; *Kamba*, Kumaon, which covers large areas, like heather does in Europe, in the higher Himalayan regions above 10,000 ft.

4. LEUCOTHOE, D. Don. *L. Griffithiana*, Clarke, is a shrub of the Eastern Himalaya, found by Griffith in Bhutan.

5. PIERIS, D. Don.

Three species. *P. villosa*, Hook. f.; Fl. Br. Ind. iii. 461; Gamble Darj. List 51, is a small tree of the Himalaya most common in Sikkim at elevations over 10,000 ft., but also found as far west as the Tons river. This is probably the kind found in the underwood of the Molta Forest in Jaunsar at about 7500 ft., though Babu Upendranath Kanjilal in his Flora does not mention it. *P. formosa*, D. Don; Fl. Br. Ind. iii. 461; Gamble Darj. List 51 (*Andromeda formosa*, Wall.; Brandis For. Fl. 280); Vern. *Sheaboge*, Nep., is an evergreen tree of the Central and Eastern Himalaya from Kumaon to Bhutan at rather low levels and of Assam.

1. P. ovalifolia, D. Don; Fl. Br. Ind. iii. 460; Gamble Darj. List 51. *Andromeda ovalifolia*, Wall.; Brandis For. Fl. 280; Kurz For. Fl. ii. 92. Vern. *Ayatta, eilan, ellal, arur, arwán, aira, ailan, rattankát*, Pb.; *Eran, yarta, ladrang*, Sutlej; *Anyár*, Kumaon; *Ayár*, Hind.; *Gáshing*, Byans; *Anjir, angiár, aigiri, jagguchal*, Nep.; *Piazay*, Bhutia; *Kangshior*, Lepcha.

A deciduous tree. *Bark* brown, thick, fibrous, peeling off in long narrow strips, deeply cleft, the clefts often extending spirally round the stem. *Wood* light reddish-brown, soft, even-grained, but warps badly. *Annual rings* marked by slightly larger pores in the spring wood. *Pores* small in the spring wood, very small in the autumn wood. *Medullary rays* fine to moderately broad, dark, showing as a neat silver-grain.

Outer Himalaya, at 2–8000 ft., from the Indus to Bhutan; Khasia Hills at 3–5000 ft.; hills of Martaban at 3–5000 ft.; Kachin Hills in Upper Burma.

A common tree, characteristic in the Western Himalaya as always accompanying the "Ban" oak (*Quercus incana*) and the rhododendron on grassy hill slopes, but rarely below 5000 ft. In Sikkim it is found at much lower elevations than in the west, and is met with equally in the Sál forests of the Tista Valley at 2000 ft. and among the rhododendrons of Tonglo at 10,000. It is a useful tree on the slopes of the West Himalaya, as helping to cover the ground quickly and act as a nurse to deodar where it has been planted or sown or has come up naturally. It is also useful, as it is not eaten by cattle and can survive the forest fires. But its wood is of little or no value, for it does not even burn well or make good charcoal, going quickly into dust; it is, however, even-grained, and cuts nicely, and, if previously well seasoned, is capable of utilization in turning. The growth is usually slow, Brandis puts it at 34 rings per inch, but 12 to 18 is more usual in the west, and about 6 in Sikkim. The leaves are poisonous to goats; of this I have seen cases, but J. L. Stewart says it only happens in the spring months, which may be the case, as such animals are only likely to eat them at that time, when they are soft and juicy. Madden says that the honey from the flowers is also poisonous. The leaves can be used as an insecticide.

			lbs.
H	17.	Simla, 7000 ft.	41
E	8325.	Darjeeling Hills, 6500 ft. (Gamble).	—

6. ENKIANTHUS, Lour.

1. **E. himalaicus,** Hook. f. and Th.; Fl. Br. Ind. iii. 461; Gamble Darj. List 51. Vern. *Chothu*, Nep.

A small tree. *Bark* thin, grey. *Wood* light brown, moderately hard, even-grained. *Annual rings* marked by a belt of more numerous *pores* than in the rest of the wood, where they are very small, and joined by wavy, concentric, fine, pale bands. *Medullary rays* moderately broad and fine.

Sikkim Himalaya, at 10–12,000 ft., among the rhododendrons.

E 976. Chumbi Valley, Tibet, 10,000 ft. (Schlich).
E 3725. Tonglo, Darjeeling, 10,000 ft. (Gamble).

7. DIPLARCHE, Hook. f. and Th. Two small shrubs of the higher Sikkim Himalaya, of no importance.

8. RHODODENDRON, Linn.

A genus of beautiful trees and shrubs, found in the Himalaya and the mountains which connect it with Burma and run down into the Malay Peninsula. One species only occurs in South India and Ceylon. Forty-two Indian species were described in the Fl. Br. Ind., which chiefly followed the descriptions given, with beautiful plates, in Sir J. D. Hooker's "Rhododendrons of the Sikkim Himalaya." To these forty-two, two were added by Aitchison and Hemsley from the mountains on the western border adjoining Afghanistan: these are *R. afghanicum*, Aitch. and Hemsl., and *R. Collettianum*, Aitch. and Hemsl., both shrubs; and one, *R. modestum*, Hook. f., has recently been added, by the curious fact of its having been raised among seedlings of another species from seed sent to Kew from Sikkim.

The genus *Rhododendron* is divided into four sections, three of which contain each only one species in the region of this work, so that the greater number, including the most important kinds, belong to the sub-genus *Eurhododendron*. Most of the species, other than those whose woods are here described, are merely shrubs, and however interesting they may be to the botanist and horticulturist, they are of but little importance in the forest economy of India, so that it is unnecessary to do more than mention a few of them. *R. moulmainense*, Hook. f.; Fl. Br. Ind. iii. 463; Kurz For. Fl. ii. 94; Vern. *Zalatpyu*, Burm., is a tree of some size, reaching 40 ft. in height and a girth of 4 ft., in the hill forests, especially the damper ones, of Martaban and Tenasserim at 4–7000 ft. In the Khasia Hills as well as in the stunted hill forests of the Nattoung range at 7000 ft., is found *R. formosum*, Wall., an evergreen shrub. *R. Thomsoni*, Hook. f.; Fl. Br. Ind. iii. 468; Gamble Darj. List 52, is a shrub found at 11–13,000 ft. in the Sikkim Himalaya with beautiful dark crimson flowers. *R. Griffithianum*, Wight; Fl. Br. Ind. iii. 468; Gamble Darj. List 52 (*R. Aucklandii*, Hook. f.), is a tree of the Sikkim and Bhutan Himalaya with white, pink-spotted flowers. In the Himalaya, chiefly Western and Central, two small species are found on rocks at high elevations: viz. *R. Anthopogon*, Don; Brandis For. Fl. 282; Vern. *Nichni*, *rattankát*, *nera*, Jhelum; *Tazak-tsun*, Kashmir; *Kái zabán*, *morúa*, *talisa*, Ravi; *Talisri*, Beas; *Talisfar*, Kumaon; *Palu*, Bhutia, with yellowish-white, and *R. lepidotum*, Wall. (same reference and names) with red flowers. They do not occur below 10,000 ft., but are common above that elevation, and their leaves are used as stimulants in native medicine. In the Darjeeling Hills, above 6000 ft. two beautiful shrubby species are found, usually epiphytic and of some size. These are *R. Dalhousiæ*, Hook. f. and *R. Edgeworthii*, Hook. f.; Gamble Darj. List 52; Vern. *Gurás*, Nep., the former with glaucous leaves and very large cream-coloured scented flowers, the latter with woolly leaves and pure white cinnamon-scented flowers. *R. nivale*, Hook. f. is a very small prostrate species, hardly rising 2 in. from the ground, but noticeable as probably reaching the highest elevation, 16–18,000 ft., of any Indian woody plant (Sir J. D. Hooker says "of any shrub in the world"), and as being at the same time very highly scented with the

odour of "Eau de Cologne." Some of the Himalayan rhododendrons have been successfully grown in the south of England, but are tender—the hardy species are mostly American species or from Asia Minor, like the commonest one, *R. ponticum*, Linn.

Wood pale brown, red or yellow, even-grained, smooth, soft or moderately hard. *Pores* very fine or extremely fine, more numerous in the spring wood. *Medullary rays* fine, generally short, sometimes with additional moderately broad ones. The wood is apt to warp and shrink.

1. **R. grande,** Wight; Fl. Br. Ind. iii. 464; Gamble Darj. List 51. *R. argenteum*, Hook. f. Vern. *Kali gurás, putlinga*, Nep.; *Etok-amat*, Lepcha.

An evergreen tree. *Bark* reddish-brown, peeling off in small scales. *Wood* yellowish, with darker heartwood, shining, soft, close- and even-grained. *Pores* very small, somewhat more numerous in the spring wood, where they mark the annual rings. *Medullary rays* of two sizes, very fine and very numerous between fewer short and moderately broad rays, dark.

Hills of Sikkim, common on the outer ranges round Darjeeling and Dumsong, at 6–10,000 ft.

Growth slow, 27 rings per inch of radius. The wood warps less than that of *R. arboreum*. Flowers pure white, with a purple throat.

		lbs.
E 372.	Tonglo, Darjeeling, 9000 ft. (Johnston)	39

2. **R. Hodgsoni,** Hook. f.; Fl. Br. Ind. iii. 464; Gamble Darj. List 51.

A large shrub. *Bark* very thin, light brown, smooth. *Wood* yellowish-white, moderately hard, close- and even-grained. *Annual rings* marked by a line in the autumn wood. *Pores* extremely small and numerous. *Medullary rays* extremely fine and numerous.

Eastern Himalaya from Nepal to Bhutan, at 10–12,000 ft.; common on the Singalila range above Darjeeling.

Hooker says of this species that he always regards it, with *Abies Webbiana*, as the characteristic plant at the elevation of 10–12,000 ft. in the valleys of Sikkim. The growth is exceedingly slow, his specimen showing about 63 rings per inch of radius. The wood is made into cups, spoons and ladles as well as Yak saddles, and the large leaves are used to line baskets and pack butter. The flowers are rose-coloured or purplish.

Sikkim Himalaya—Kew Museum (J. D. Hooker).

3. **R. Falconeri,** Hook. f.; Fl. Br. Ind. iii. 465; Gamble Darj. List 51. Vern. *Kurlinga*, Nep.; *Kégu, kalma*, Bhutia.

A moderate-sized evergreen tree. *Bark* reddish-brown, peeling off in flakes; inner bark purple-red. *Wood* reddish-white, shining with a beautiful satiny lustre, takes a beautiful polish, hard, close- and even-grained. *Annual rings* marked by more numerous pores in the spring wood. *Pores* very small and extremely small. *Medullary rays* fine and moderately broad, short. Frequent medullary patches.

Hills of Sikkim, especially the summit of Tonglo, at 10,000 ft.; Naga Hills and Manipur.

A fine species, with a straighter bole and with a less branching habit than most species. The leaves are very large, wrinkled and ferruginous beneath. Growth slow, 17 rings per inch of radius. The wood does not warp. Flowers cream-coloured.

		lbs.
E 369.	Tonglo, Darjeeling, 10,000 ft. (Johnston)	39

4. **R. arboreum,** Sm.; Fl. Br. Ind. iii. 465; Bedd. Fl. Sylv. t. 228; Brandis For. Fl. 281; Kurz For. Fl. ii. 93; Gamble Darj. List 51; Trimen Fl. Ceyl. iii. 63. *R. puniceum*, Roxb. Fl. Ind. ii. 409. Vern. *Chhán*, Hazara; *Ardáwal*, Jhelum; *Mandál*, Chenab; *Chiu, áru*, Ravi; *Brás, sprek*, Sutlej; *Búrans*, Jaunsar; *Brus, brons*,

Kumaon; *Tofshing*, Byáns; *Garáns*, Dotiál; *Bhoráns*, *gurás*, *ghonás*, *taggú*, *lal gurás* Nep.; *Etok*, Bhutia, Lepcha; *Billi*, Badaga; *Poo*, Tam.; *Zalatni*, Burm.; *Ma-ratmal* Cingh.

A small evergreen tree. *Bark* 1 in. thick, reddish-brown, peeling off in small flakes. *Wood* soft, reddish-white or reddish-brown, close- and even-grained, apt to warp and shrink. *Annual rings* marked by a belt of slightly larger pores in the spring wood. *Pores* very small and extremely small, uniformly distributed. *Medullary rays* of two classes, few moderately broad, short, separated by many fine, regular ones, the broader, forming a somewhat indistinct silver-grain.

Outer Himalaya from the Indus to Bhutan, at 5–11,000 ft.; Khasia Hills at 4–6000 ft.; hills of the Ruby Mines District and of the Karenni country near Toungoo in Burma; hills of South India, common in the Nilgiris, Pulneys and Anamalais and the hills of Travancore; hill region of Ceylon.

As already mentioned under *Pieris ovalifolia*, this tree, the ordinary rhododendron of common talk, is found, in the West Himalaya, in forests of the "Ban" oak on grassy lands at 5–7000 ft. It also occurs in thick forest at high elevations like the upper part of Kedarkanta, at 10–12,000 ft., where I have seen it with "Kharshu" oak, silver fir and small bamboo. In the Darjeeling Hills it is not so common, the ordinary typical variety being found on the drier slopes at 6–8000 ft., and the var. *Campbelliæ* in nearly pure forest or with *R. grande*, *Falconeri* and *barbatum* at 10–11,000 ft.; in the Nilgiris and Ceylon it prefers open ground, and there it is the well-marked round-leaved var. *nilagirica*. Everywhere, it is a beautiful tree, but is scarcely ever straight-grown, being usually, even though of considerable diameter, much branched and wide-crowned. Seedlings come up self-sown in profusion, especially on banks where the soil has been laid bare as on road-cuttings; but they are difficult to raise in nursery and propagate artificially. It is an excellent nurse for deodar plantations on grass land where it occurs. The flowers are usually crimson, but may vary through different shades to white.

The wood is scarcely used except as fuel, and on its value as firewood there are different opinions, some considering it not good, others liking it much. It is apt to smoulder instead of burning with a flame. As charcoal, it is not good. I never saw it used in building, though I have experience of it in such widely separated places as Simla, Chakrata, Mussoorie, Darjeeling, the Nilgiris and Newera Ellia. It is, however, used for plates and dishes, for "kukri" handles, and Beddome says it is used for gunstocks, but this is doubtful, as few such are manufactured in S. India. The growth is slow: Brandis says 14 rings per inch, while the specimens examined varied from 12 rings in the West Himalaya and the Nilgiris to as many as 36 in Sikkim. The wood warps badly and shrinks in seasoning. The flowers are used in Buddhist temples; they are eaten and made into jelly at Simla. The average weight of the wood seems to be about 40 lbs. per cubic foot.

The leaves are often badly attacked by an orange-coloured fungus, *Chrysomyxa himalayensis*, Barcl.

	lbs.
H 3171. Dungagalli, Hazara, 7000 ft. (Wild)	—
H 14, 73. Simla Forests, 7000 ft..	45
E 383, 2388, 3706. Tonglo, Darjeeling, 10,000 ft. (Johnston and Gamble)	39
These three are var. *Campbelliæ*.	
W 3881, 4097. Ootacamund, Nilgiris, 7000 ft. (Gamble) . . .	35
These two are var. *nilagirica*.	
Nordlinger's Sections, vol. 8 (Tab. IX. 3).	

5. R. campanulatum, Don; Fl. Br. Ind. iii. 466; Brandis For. Fl. 281. Vern. *Gaggar*, *yurmi*, Kashmir; *Sarugar*, *shinwala*, Ravi; *Shargar*, Beas; *Shengra*, Pangi; *Simrung*, Sutlej; *Simris*, Tehri; *Chimul*, Kumaon; *Cheriala*, *teotosa*, Nep.

An evergreen shrub. *Bark* thin, cinnamon-coloured or grey, smooth, peeling off in thin papery flakes. *Wood* light pinkish-red, moderately hard. *Annual rings* distinctly marked by more numerous pores in the spring wood. *Pores* very small and extremely small, very numerous. *Medullary rays* very fine, very short.

Inner Himalaya from the Indus to Nepal, between 9500 and 14,000 ft.; outer ranges on high mountains such as the Chor, Chansil and Kedarkanta; Sikkim at 11,000 ft. (Clarke).

This is a large lilac-flowered shrub, extensively gregarious on high peaks and at the upper limit of tree-vegetation, most difficult to penetrate. The leaves are said to be poisonous, but they are very leathery and tough, so that cattle, in all probability, rarely touch them. J. L. Stewart says the smoke of the burning leaves is very acrid and irritant. Growth moderate to slow: the specimens examined show 28 rings per inch of radius; while Aikin with Wallich's specimens found 8·4 rings per inch, very distinctly marked.

		lbs.
H 121.	Jalari Pass, Seoraj, Kulu, 10,000 ft. (Stenhouse)	39
H 128.	Rotang Pass, Kulu, 13,000 ft. (Stenhouse)	—
H 4775.	Rikshin, Tehri-Garhwal, 10,000 ft. (Gamble)	39
	Sikkim Himalaya—Kew Museum (J. D. Hooker).	

6. **R. fulgens,** Hook. f.; Fl. Br. Ind. iii. 466; Gamble Darj. List 51. Vern. *Chimal*, Nep.

A small tree or large shrub. *Wood* grey, darker in the centre, moderately hard, even-grained. *Annual rings* marked by more porous wood at the inner edge. *Pores* extremely small and numerous. *Medullary rays* short, fine, very numerous.

Sikkim Himalaya, at 12–14,000 ft.

A fine crimson-flowered shrub, leaves brown-felted beneath, common about Sandúkpho and more or less gregarious. Growth slow, 25 rings per inch of radius.

		lbs.
E 2957.	Sandúkpho, Darjeeling, 12,000 ft. (Gamble)	36

7. **R. Wightii,** Hook. f.; Fl. Br. Ind. iii. 467; Gamble Darj. List 52.

A small shrubby tree. *Bark* extremely thin, cinnamon-red, peeling off in papery flakes. *Wood* light yellowish-white, moderately hard, very close- and even-grained. *Pores* very small, rather scanty. *Medullary rays* red, very fine, short.

East Nepal and Sikkim at 11–14,000 ft., abundant in wooded valleys and on spurs.
The flowers are yellow with a crimson throat and spots.
Sikkim Himalaya, 14,000 ft.—Kew Museum (J. D. Hooker).

8. **R. campylocarpum,** Hook. f.; Fl. Br. Ind. iii. 467.

A shrub. *Bark* very thin, light brown, peeling off in thin papery flakes. *Wood* light yellow, moderately hard, close- and even-grained. *Pores* extremely small and numerous. *Medullary rays* fine, short.

East Nepal and Sikkim, at 11–14,000 ft., in rocky valleys and on open spurs.
The flowers are of a pale sulphur colour and the bush has a resinous scent.
Sikkim Himalaya—Kew Museum (J. D. Hooker).

9. **R. barbatum,** Wall.; Fl. Br. Ind. iii. 458; Gamble Darj. List 52. Vern. *Gurás*, *chimal*, Nep.; *Kému*, Bhutia.

A small evergreen tree. *Wood* light pinkish-red, shining. *Annual rings* marked by a belt of more numerous and larger pores. *Pores* very small and extremely small. *Medullary rays* fine and very fine, numerous.

Eastern Himalaya, at 8–11,000 ft.; common on Mount Tonglo with *R. arboreum.*
Growth slow, 35 rings per inch of radius. Flowers deep crimson.

		lbs.
E 375.	Tonglo, Darjeeling, 10,000 ft. (Johnston)	39

10. **R. Maddeni,** Hook. f.; Fl. Br. Ind. iii. 472; Gamble Darj. List 52.

A shrub. *Bark* pale purplish-red, peeling off in papery flakes and

leaving a dark under-surface. *Wood* light brown, moderately hard, close- and even-grained. *Pores* extremely small and numerous. *Medullary rays* brown, fine, very numerous.

Sikkim and Bhutan Himalaya, at 6–7000 ft. This species is rare: it has large white flowers.

Sikkim Himalaya—Kew Museum (J. D. Hooker).

11. R. cinnabarinum, Hook. f.; Fl. Br. Ind. iii. 474; Gamble Darj. List 52. Vern. *Búlú*, Nep.; *Kema kechoong*, Lepcha.

A large shrub. *Bark* thin, reddish-grey. *Wood* light greyish- or yellowish-white, moderately hard, even-grained, warps. *Annual rings* not visible. *Pores* extremely small. *Medullary rays* short, fine, very numerous.

Sikkim Himalaya above 12,000 ft.

The leaves are poisonous and the smoke of the wood causes inflammation of the face and eyes, according to Hooker. Flowers scarlet.

	lbs.
E 2958. Sandúkpho, Darjeeling, 12,000 ft. (Gamble)	42

Sikkim Himalaya, 12,000 ft.—Kew Museum (J. D. Hooker).

Order LXIV. EPACRIDEÆ.

An Order of plants, closely allied to *Ericaceæ*, of which nearly all the species are Australian. Only one species of the Order extends as far north as Tenasserim: *Leucopogon malayanus*, Jack; Fl. Br. Ind. iii. 477; Kurz For. Fl. ii. 95, an evergreen, small, rigid shrub. The wood of an Australian species in Nordlinger's Sections, vol. 6, is very like that of some Rhododendrons, having very small, very numerous, evenly distributed *pores*; and *medullary rays* of two classes, few moderately broad, with many very fine between.

Order LXV. PLUMBAGINEÆ.

An Order of herbaceous or shrubby plants, many of which affect dry sandy country. Only two genera, however, seem to be worthy of mention here, and one of them, Vogelia, contains only one species, *V. indica*, Gibs.; Fl. Br. Ind. iii. 481, a small shrub of Western India, common at Mount Abu.

1. ÆGIALITIS, R. Br.

1. Æ. rotundifolia, Roxb. Fl. Ind. ii. 111; Fl. Br. Ind. iii. 479. *Æ. annulata*, Kurz For. Fl. ii. 96.

An evergreen shrub or "treelet." *Bark* grey, soft, lenticellate. *Wood* soft, spongy, with a structure outwardly resembling that of a monocotyledonous plant, consisting of soft cellular tissue, studded with scattered small patches of pore-bearing wood. These contain each a single radial line of pores in ordinary cellular tissue. The soft tissue consists of large fibrous stellate cells of very interesting character.

Tidal forests of the Sundarbans, Chittagong, Arracan, Burma and the Andaman Islands.

A curious plant, like a miniature tree, but with conical stem and large leaves with a dilated petiole.

E 3644. Sundarbans (Gamble).

Order LXVI. MYRSINEÆ.

Contains ten genera of Indian trees, shrubs or climbers, belonging to the following Tribes:—

Tribe I. Mæseæ . . . . Mæsa.
„ II. Eumyrsineæ . . . Myrsine, Embelia, Ardisia, Pimelandra, Antistrophe, Hymenandra, Amblyanthus, Ægiceras.
„ III. Theophrasteæ . . . Reptonia.

The Order is not an important one, still, the gregarious shrubby growth, resembling that of Hazel in England, which characterizes *Mæsa Chisia* in the Darjeeling Hills, makes it of interest sylviculturally; *Ægiceras* has one of the best and hardest of the woods of the "Mangrove" forests; and *Reptonia* is a valuable shrub of the driest part of the Punjab. The leaves of several of the species are characterized by resinous glands; and these occur sometimes again in the wood. *Jacquinia ruscifolia*, Jacq. is not uncommon in gardens in Madras.

Wood compact, close-grained. *Pores* very small or extremely small, often in groups or radial or oblique lines. *Medullary rays* distant, fine to broad, more often broad. *Resin ducts* frequent, sometimes among the wood-cells, sometimes in the rays. The woods of this family are curious and interesting in their microscopic structure, and clearly deserve special study. In a section of a *Jacquinia* (Nordlinger's Sections, vol. 6), the medullary rays branch outwards, a very unusual character. The resin-cells, of various shapes, are also strange.

1. MÆSA, Forsk.

Eleven species, trees or shrubs. An interesting genus, mostly of undershrubs of thick forest or of small trees which come up on clearings or after temporary cultivation. *M. ramentacea*, A. DC; Fl. Br. Ind. iii. 508; Kurz For. Fl. ii. 99 (*Bæobotrys ramentacea* and *glabra*, Roxb. Fl. Ind. 558, 560), is an evergreen tree of the forests on the hills of Chittagong and Burma, the Andamans and Nicobars, chiefly on old temporary cultivation or "poonzohs," said by Kurz to have a "pale brown or brown, rather heavy, close-grained, brittle" wood. *M. andamanica*, Kurz For. Fl. 575; Fl. Br. Ind. iii. 508, is an evergreen small tree of the Andamans. *M. paniculata*, A. DC; Fl. Br. Ind. iii. 509; Kurz For. Fl. ii. 99, is an evergreen shrub of Sylhet, also found in Tavoy and Tenasserim. *M. dubia*, Wall.; Fl. Br. Ind. iii. 510; Talbot Bomb. List 117, is a shrub of the evergreen forests of the Konkan, Kanara, Malabar and Mysore. *M. argentea*, Wall.; Fl. Br. Ind. iii. 510; Brandis For. Fl. 283; Vern. *Phusera, gogsa*, N.-W. Provinces, is a large shrub of the Central Himalaya from the Ganges to Sikkim, at 3–7000 ft., with a white edible berry. *M. mollis*, A. DC; Fl. Br. Ind. 510 (*M. mollissima*, Kurz For. Fl. ii. 100), is an evergreen shrub of the tropical forests of Burma extending to the Shan Hills; and *M. muscosa*, Kurz For. Fl. ii. 100; Fl. Br. Ind. iii. 511, is found in the region between Burma and Assam, about the Patkoye range.

Wood light brown, soft. *Pores* small, scanty, sometimes in short radial lines, often filled with resin. *Medullary rays* usually fine, numerous.

1. **M. rugosa,** Clarke; Fl. Br. Ind. iii. 508; Gamble Darj. List 52.

A large shrub or small tree. *Bark* thin, resinous, reddish-brown. *Wood* soft, light brown. *Pores* small, scanty, some resinous and these chiefly in the outer sapwood. *Annual rings* marked by a dark line. *Medullary rays* fine, very numerous.

Eastern Himalaya, in Sikkim and Bhutan, at 5-7000 ft.

E 3669. Laba, British Bhutan, 6000 ft. (Gamble).

2. M. Chisia, Don; Fl. Br. Ind. iii. 509; Gamble Darj. List 52. Vern. *Bilauni*, Nep.; *Purmo*, Lepcha.

An evergreen gregarious shrub or small tree. *Bark* thin, reddish-brown. *Wood* light brown, soft. *Pores* small, scanty, uniformly distributed. *Medullary rays* moderately broad, numerous.

Eastern Himalaya, from Nepal to Bhutan, at 4–6000 ft.; Khasia Hills at 3–5000 ft. This shrub is very common over large areas of country in the Darjeeling Hills, coming up gregariously on hill slopes which have at one time or another been cultivated and then abandoned. How far it might be useful as giving a coppice growth fit to afford fuel, I cannot say, as the question has not, that I know of, been raised; but in affording protection to planted trees of more valuable timber, put out in lines or in patches cut in the shrubby growth, I can imagine nothing better. The growth is fairly fast, 6 rings per inch of radius.

E 2389. Tukdah Forest, Darjeeling, 6000 ft. (Gamble).

3. M. indica, Wall.; Fl. Br. Ind. iii. 509; Bedd. Fl. Sylv. cxxxvii.; Brandis For. Fl. 283; Kurz For. Fl. ii. 99; Gamble Darj. List 52; Talbot Bomb. List 117; Trimen Fl. Ceyl. iii. 67. *Baeobotrys indica* and *nemoralis*, Roxb. Fl. Ind. i. 557–9. Vern. *Kalsis*, Garhwal; *Nanapadhera*, Kumaon; *Atki*, Bombay; *Bilauni*, Nep.; *Purmo*, Lepcha; *Phuduppjoh*, Mechi; *Ramjani*, Beng.; *Tamomban*, Magh; *Kirithi*, Travancore Hills; *Mata-bimbiya*, Cingh.

An evergreen shrub or small tree. *Bark* thin, reddish-brown, with frequent reddish lenticels, somewhat horizontally arranged. *Wood* brownish-white, soft. *Pores* small, scanty and often in strings of 2 to 4. *Medullary rays* fine, numerous.

Throughout India: in the Lower Himalaya from the Jumna eastward; Eastern Bengal and Burma up to 3000 ft.; occasional in Central India, Orissa and the Circars; in shady places in the Deccan and Carnatic; South and West India, common; Ceylon, up to 6000 ft., usually in valleys and ravines in forest undergrowth.

A very common plant and widespread, but, just as *M. Chisia* prefers open hillsides, so in Sikkim this species prefers shady ravines. Elsewhere, also, I have always seen it only in such places, though C. B. Clarke, whose experience is undoubted, says in "Fl. Br. Ind." that it grows on lands gone out of cultivation like *M. Chisia* and *M. macrophylla*.

W 3762. Coonoor, Nilgiris, 6000 ft. (Gamble).

4. M. macrophylla, Wall.; Fl. Br. Ind. iii. 570; Gamble Darj. List 52. Vern. *Bogoti*, Nep.; *Tugom*, Lepcha.

A small tree. *Bark* thin, rough with longitudinal narrow clefts, resinous when cut. *Wood* light brown, moderately hard. *Pores* small, scanty, often in short radial lines, those in the sapwood filled with yellow resin. *Medullary rays* fine to moderately broad, numerous.

Eastern Himalaya, from Nepal to Bhutan, common in second-growth forest and old cultivated lands.

E 3670. Kalimpúng, British Bhutan, 4000 ft. (Gamble).

2. MYRSINE, Linn.

Three species.

1. M. africana, Linn.; Fl. Br. Ind. iii. 511; Brandis For. Fl. 286. Vern. *Bebrang*, *kakhum*, *kokhúri*, *karuk*, *gugul*, *jutru*, *chachri*, *pratshu*, *branchu*, *khúshin*, *pápri*, *bandáru*, *binsin*, *atuljan*, Pb.; *Chitring*, Sutlej; *Guvaini*, *pahari cha*, *chúpra*, Hind.; *Danwan*, Jaunsar; *Ghari*, Kumaon; *Jhiún*, *rikhdalmi*, Garhwal; *Jasún*, Dotiál.

A small evergreen shrub. *Bark* thin, dark brown with large lenticels. *Wood* light brown, moderately hard. *Pores* extremely small, scattered or in short radial lines, between the distant, moderately broad *medullary rays*, which contain many resin-cells.

Afghanistan, Salt Range and Outer Himalaya as far east as Nepal. Also in S. Africa. The fruit is used as an anthelmintic, sold under the name of *Bebrang*, and often used as a substitute for that of *Samara Ribes*. The shrub prefers shady places in the drier forests like those of "Ban" oak and rhododendron.

		lbs.
H 2829.	Simla, 6000 ft. (Gamble)	49

Nordlinger's Sections, vol. 5 (*M. retusa*, Ait.).

2. M. semiserrata, Wall.; Fl. Br. Ind. iii. 511; Brandis For. Fl. 285; Kurz For. Fl. ii. 105; Gamble Darj. List 52. Vern. *Parwana*, *kúngkúng*, *gogsa*, *bamora*, *gaunta*, Hind.; *Chupra*, Garhwal; *Gaderi*, *gaunt*, Kumaon; *Bilsi*, *beresi*, *kalikatha*, *bilauni*, Nep.; *Tungcheong*, Lepcha.

A shrub, small or middling sized tree. *Bark* ash-coloured, dark, nearly black, with prominent dots. *Wood* red, hard. *Pores* extremely small, in small patches between the distant, broad *medullary rays*.

Outer Himalaya from the Beas to Bhutan, at 3–9000 ft.; Khasia Hills at 3–5000 ft.; Nattoung Hills of Martaban at 6–7500 ft.

Wallich says the wood is chocolate-coloured, heavy, hard, handsome and used in Nepal for carpenters' work. It splits rather and is usually too small for anything but firewood.

		lbs.
H 2830.	The Glen, Simla, 6000 ft. (Gamble)	51
E 3322.	Darjeeling, 6500 ft. (Gamble)	—

3. M. capitellata, Wall.; Fl. Br. Ind. iii. 512; Brandis For. Fl. 286; Gamble Darj. List 52; Talbot Bomb. List 117; Trimen Fl. Ceyl. iii. 68. *M. Wightiana*, Wall.; Bedd. Fl. Sylv. t. 234. *M. avenis*, A. DC; Kurz For. Fl. ii. 105. Vern. *Phalamkat*, Nep.; *Kokili*, Badaga.

A small tree. *Bark* ⅛ in. thick, grey, smooth. *Wood* moderately hard, grey. *Pores* small, rather scanty, isolated or in short radial lines between the distant broad *medullary rays*. These latter are also characterized by occasional red or yellow spots, which are apparently resin-cells and are not seen in the cellular tissue containing the pores which comes between the rays. Wood-cells large, prominent.

Central and Eastern Himalaya, up to 4000 ft.; Assam and the Khasia Hills; drier hill forests of Martaban in Burma at 4–7000 ft., a variety (*M. lucida*, Wall.) in the Eng forests of Prome; hills of South India from North Kanara down, chiefly at 5–7000 ft., common in Nilgiri sholas; hill region of Ceylon.

This tree resembles a holly, and is very variable. Beddome says the wood is hard and durable. Wallich gives W = 22 lbs., but the specimens here described are heavier. Fruit edible.

		lbs.
E 3663.	Dumsong, Darjeeling, 5000 ft. (Gamble)	—
W 3747.	Coonoor, Nilgiris, 6000 ft. "	—
W 4181.	Fairlawns, Ootacamund, 7000 ft. "	48

The two last are var. *lanceolata*, Wall., and have narrower medullary rays.

3. EMBELIA, Burm.

About 14 species of erect or climbing shrubs, most of which are found in Eastern Bengal, Burma or South India. *E. parviflora*, Wall.; Fl. Br. Ind. iii. 515; Kurz For. Fl. ii. 104, is a climbing shrub of the Khasia Hills and of Upper Burma; where also, in the Shan Hills, is found *E. furfuracea*, Coll. and Hemsl. *E. Gamblei*, Kurz; Fl. Br. Ind. iii. 516; Gamble Darj. List 53; Vern. *Amili*, Nep.; *Monkyourik*, Lepcha, is a common climber of the Darjeeling forests at 6–8000 ft. with thick spongy bark and soft wood with large pores and very broad medullary rays. Its leaves are eaten by hill-men. Haines, quoted in "Darjeeling Working Plan," 1893, p. 59, says it is one of the most injurious climbers in the hill forests, having dense persistent foliage and pendulous branches. *E. vestita*, Roxb. and *E. nutans*, Wall., are climbing shrubs of Assam.

Except *E. robusta* all those examined are climbers with a curious

and interesting structure. *Bark* lenticellate. *Wood* usually brown. *Pores* small in *E. robusta*, large in the rest. *Medullary rays* broad to extremely broad.

1. **E. Ribes,** Burm.; Fl. Br. Ind. iii. 513; Roxb. Fl. Ind. i. 586; Bedd. Fl. Sylv. cxxxviii.; Brandis For. Fl. 284; Kurz For. Fl. ii. 101; Gamble Darj. List 53; Talbot Bomb. List 117; Trimen Fl. Ceyl. iii. 69. Vern. *Bebrang*, Sylhet; *Himalchiri*, Nep.; *Bhringeli*, Melghát; *Waiwarung, karkunnie*, Bombay; *Wel-embilla*, Cingh.

A large scandent shrub. *Bark* ½ in. thick, brown, rough with conical hard protuberances. *Wood* light brown, porous. *Pores* variable, large to small, the large ones sometimes in concentric rings. *Medullary rays* broad.

Throughout the greater part of India: Central and Eastern Himalaya, Assam and Burma; Western and Southern India and Ceylon; in evergreen forests.

The berries are used as an anthelmintic and to adulterate black pepper.

W 3751. Lamb's Rock Shola, Nilgiris, 6000 ft. (Gamble).

2. **E. floribunda,** Wall.; Fl. Br. Ind. iii. 514; Kurz For. Fl. ii. 102 (in part); Gamble Darj. List 53. Vern. *Himalchiri*, Nep.; *Payong*, Lepcha.

A large climber. *Bark* rough, tubercled. *Wood* pinkish-white. *Pores* large, more regular in size than in *E. Ribes*, sometimes subdivided and often in concentric lines. *Medullary rays* very broad.

Eastern Himalaya, from Nepal to Bhutan, at 4–7000 ft., very common about Darjeeling; Nattoung hills of Martaban at 6–7200 ft.

E 3294. Sepoydura, Darjeeling, 6000 ft. (Gamble).

3. **E. robusta,** Roxb. Fl. Ind. i. 587; Fl. Br. Ind. iii. 515; Bedd. Fl. Sylv. cxxxvii.; Brandis For. Fl. 284; Kurz For. Fl. ii. 102; Gamble Darj. List 53; Talbot Bomb. List 117; Trimen Fl. Ceyl. iii. 70. Vern. *Gaia*, Dehra Dún; *Amti, barbatti, byebering*, Bombay; *Bebrang*, Oudh; *Kopadalli*, Gondi; *Bharangeli*, Kurku; *Kalay bogoti*, Nep.; *Ambati*, Mar.; *Babri*, Monghyr; *Mata sura*, Sonthal; *Nuninunika*, Uriya; *Saradi*, Khond; *Eikmwenwè*, Burm.

A large shrub or small tree. *Bark* ¼ in. thick, brown, with horizontal cracks. *Wood* reddish. *Pores* small, often in groups or short radial lines. *Medullary rays* extremely broad to broad, with yellow, apparently resinous spots within them, as in *Myrsine capitellata*.

Almost throughout India: in the sub-Himalayan tract from the Jumna eastwards, Bengal, Behar, Western India, Burma and Ceylon, usually in deciduous forest.

		lbs.
O 2478.	Gonda, Oudh	37
C 3438.	Ramundag Reserve, Palamow (Gamble)	—
C 3528.	Khurdha Forests, Orissa (Gamble)	—

4. **E. Nagushia,** Don; Fl. Br. Ind. iii. 516; Gamble For. Fl. 53. Vern. *Amilpati*, Nep.

A climbing shrub. *Bark* brown, with prominent lenticels. *Wood* yellowish-white, moderately hard. *Pores* moderate-sized, more numerous in the inner part of each annual ring. *Medullary rays* moderately broad to broad, short, well defined.

Eastern Himalaya at 3-6000 ft.

The leaves are eaten by hillmen.

E 3302. Tukdah, Darjeeling, 5000 ft. (Gamble).

5. **E. viridiflora,** Scheff.; Fl. Br. Ind. iii. 516; Trimen Fl. Ceyl. iii. 70. *Samara viridiflora*, Bedd. Fl. Sylv. cxxxviii.

A large scandent shrub. *Bark* ¼ in. thick, light brown, studded with corky lenticels. *Wood* reddish-white, porous. *Pores* large or

moderate-sized, often subdivided, often resinous, the larger ones, which are usually single, in concentric rings, three in a row between the medullary rays, the others scattered between them. ***Medullary rays*** **broad, scattered.**

South India, in the hills of the Deccan, Nilgiris, etc., at 2-5000 ft., common; hill region of Ceylon 4-6000 ft.

W 3758. Coonoor, Nilgiris, 6000 ft. (Gamble).

4. ARDISIA, Swartz.

About 40 species, small trees, shrubs or undershrubs, many of them scarce, few of any interest to the forester. With the exception of *A. humilis*, which extends as far west as the Dehra Dún, they are all plants of the moist forests of Bengal, Assam, Burma, South India and Ceylon. *A. colorata*, Roxb.; Fl. Br. Ind. iii. 520 (*A. anceps*, Wall.; Kurz For. Fl. ii. 107), is a small evergreen tree of the forests of Assam, Cachar, Chittagong and Burma. *A. neriifolia*, Wall.; Fl. Br. Ind. iii. 522; Kurz For. Fl. 108; Gamble Darj. List 53 (*A. floribunda*, Wall.; Brandis For. Fl. 287), is a shrub or small tree of the Central and Eastern Himalaya from Garhwal to Bhutan, Assam, the Khasia Hills and Burma. *A. Wallichii*, A. DC; Fl. Br. Ind. iii. 528; Kurz For. Fl. ii. 112; Vern. *Kyetmaök*, Burm., is an evergreen shrub, common in the forests of Burma and nearly resembling *A. humilis*. *A. pauciflora*, Heyne; Fl. Br. Ind. iii. 529; Bedd. Fl. Sylv. cxxxviii.; Trimen Fl. Ceyl. iii. 73, is a large shrub or small tree of the undergrowth of the forests of the Western Ghâts and Ceylon.

Wood moderately hard. *Pores* small, usually in radial lines. *Medullary rays* broad.

1. **A. paniculata,** Roxb. Fl. Ind. i. 580; Fl. Br. Ind. iii. 519; Kurz For. Fl. ii. 107.

A small tree with handsome pink flowers. *Bark* thin, greyish-brown. *Wood* pinkish-white, moderately hard. *Pores* small, in radial lines. *Medullary rays* short, broad, wavy.

Assam, the Khasia Hills and Eastern Bengal down to Chittagong.

E 3367. Kasalong Reserve, Chittagong (Gamble).

2. **A. macrocarpa,** Wall.; Fl. Br. Ind. iii. 524; Gamble Darj. List 53. Vern. *Chamlani*, Nep.; *Denyok*, Lepcha.

A small erect single-stemmed shrub. *Wood* white, moderately hard. *Pores* extremely small. *Medullary rays* short, broad.

Eastern Himalaya from Nepal to Bhutan, a very common plant in the Darjeeling forests at 4-8000 ft.

Has white wax-like flowers and bright red berries, ripening in winter.

E 3315. Pugraingbong, Darjeeling, 6000 ft. (Gamble).

3. **A. involucrata,** Kurz; Fl. Br. Ind. iii. 528; Gamble Darj. List 53. Vern. *Chamlani*, Nep.; *Denyok*, Lepcha.

A large handsome shrub. *Bark* yellow, corky. *Wood* pinkish-white, moderately hard. *Pores* small, scanty. *Medullary rays* broad, short, wavy.

Eastern Himalaya, in the lower valleys and Terai evergreen forests of Sikkim.

E 3350. Sivoke Hills, Darjeeling, 1500 ft. (Gamble).

4. **A. humilis,** Vahl; Fl. Br. Ind. iii. 529; Brandis For. Fl. 287; Kurz For. Fl. ii. 110; Gamble Darj. List 53; Talbot Bomb. List 118; Trimen Fl. Ceyl. iii. 72. Vern. *Kat kamali*, Garhwal, Kumaon; *Ban-jam*, Beng.; *Kadna, katapenga*, Uriya; *Kantena, maya rawa*, C.P.; *Konda mayúr*, Tel.; *Bodina gidda*, Mysore; *Bonderi*, Khond; *Mamidi*, Reddi; *Lunu-dan*, Cingh.

A shrub. ***Bark*** **brown, smooth.** ***Wood*** **grey, moderately hard.** ***Pores*** **small, in short radial lines.** ***Medullary rays*** **broad, dark, wavy.**

Throughout India: in the sub-Himalayan tract from the Jumna eastwards; Assam, Eastern Bengal, Burma; Central India including Orissa and the Circars, the Konkan and Kanara; South India in the Deccan, Carnatic and Malabar, Ceylon, in the forest undergrowth in moist places and along streams.

		lbs.
O 4828.	Karwapani, Dehra Dún, 2000 ft. (Gamble)	39
C 3463.	Bandgaon Ghát, Singbhúm, 2000 ft. „	—

5. PIMELANDRA, A. DC. Three species, shrubs of the Khasia Hills, the chief of which is *P. eugeniæfolia*, Hook. f.; Fl. Br. Ind. iii. 530, common at 2–4000 ft.

6. ANTISTROPHE, A. DC. Two species, both shrubs, one of the Khasia Hills; the other *A. serratifolia*, Hook. f., of moist woods in the Anamalai Hills in South India.

7. HYMENANDRA, A. DC. *H. Wallichii*, A. DC; Fl. Br. Ind. iii. 532, is a shrub of Assam, Cachar and the Khasia Hills.

8. AMBLYANTHUS, A. DC. *A. glandulosus*, A. DC; Fl. Br. Ind. iii. 533, is a small shrub of the Khasia Hills and Sylhet.

9. ÆGICERAS, Gaertn.

1. **Æ. majus**, Gaertn.; Fl. Br. Ind. iii. 533; Roxb. Fl. Ind. iii. 130; Bedd. Fl. Sylv. cxxxix.; Talbot Bomb. List 118; Trimen Fl. Ceyl. iii. 74. *Æ. corniculata*, Blanco; Kurz For. Fl. ii. 114. Vern. *Halsi, khalshi, kulsi, koilsha*, Beng.; *Dudumara, guggilam*, Tel.; *Narikandam, villi kanna*, Tam.; *Kanjala*, Mar.; *Hin kadol*, Cingh.; *Butalet*, Burm.

A small evergreen tree. *Bark* grey, ¼ in. thick. *Wood* reddish-brown, often streaked with yellow, moderately hard, even-grained. *Pores* very small, scanty, uniformly distributed. *Medullary rays* moderately broad to broad, short, scanty.

Coast forests and tidal creeks of both sides of the Peninsula, the Sundarbans, Burma, the Andaman Islands and Ceylon.

A very common shrub, classed with the Mangroves and used for fuel and building huts. It grows to 20 ft. high, and is chiefly found in the Sundarbans on river-banks near the sea-face.

		lbs.
E 406.	Sundarbans (Richardson)	40
D 4324.	Tummalapenta, Nellore (Gamble)	—
D 4111.	S. Arcot forests (Wooldridge)	39

10. REPTONIA, A. DC.

1. **R. buxifolia**, A. DC; Fl. Br. Ind. iii. 534; Brandis For. Fl. 287. Vern. *Garar*, Afg.; *Gúrgúra*, Punjab.

A large evergreen shrub or small tree. *Bark* thin, dark grey, tessellated by deep longitudinal and transverse cracks. *Wood* light brown, with irregular purplish-brown heartwood, very hard, heavy, close and even-grained. *Annual rings* indistinct. *Pores* very small, arranged in wavy, radial, branching and anastomozing narrow white belts, of varying width, joined by fine, wavy, concentric lines which divide the firmer and darker tissue into irregularly shaped figures, in which the white, fine, numerous and regularly distributed *medullary rays* are distinctly visible.

Salt Range and hills Trans-Indus.

Wood worthy of attention. The fruit is eaten, and the seeds are strung in rosaries.

		lbs.
P 169.	Kohat	71
P 912.	Salt Range (Baden-Powell)	—

ORDER LXVII. SAPOTACEÆ.

An Order of considerable importance in Indian Forestry, containing only trees, most of them producing valuable timbers, some giving Gutta-percha and other products of importance, some useful fruits. There are eight genera, viz. Chrysophyllum, Sarcosperma, Sideroxylon, Isonandra, Dichopsis, Bassia, Payena, Mimusops.

Achras Sapota, Linn., is the "Sapodilla" plum, an excellent fruit, eaten, like the medlar, when slightly overripe. It is often cultivated in India. The *wood* is reddish-brown, hard, with radial groups of *pores* in oblique patches, fine *medullary rays* and irregular narrow wavy transverse lines (Nordlinger's Sections, vol. 4).

The *Argan* tree of Morocco, which is found growing gregariously near Mogador, is *Argania Sideroxylon*, R. S. Its leaves and fruit are used for fodder, and a valuable oil resembling olive oil is extracted from the seeds.

The wood of *Sapotaceæ* has a well-marked character, somewhat difficult to describe accurately, but easily recognized when understood, as it resembles no other Order except *Ebenaceæ*, where the woods are usually black or grey, while those of *Sapotaceæ* are usually red. *Wood* hard, smooth, durable; heartwood dark-coloured, generally red. *Pores* small and moderate-sized, in wavy, radial lines, which are frequently oblique, the lines being more or less in echelon. *Medullary rays* numerous, fine, equidistant, joined by fine, transverse bars or concentric lines of loose texture.

1. CHRYSOPHYLLUM, Linn.

1. C. Roxburghii, G. Don; Fl. Br. Ind. iii. 535; Bedd. Fl. Sylv. t. 236; Kurz For. Fl. ii. 118; Talbot Bomb. List 119; Trimen Fl. Ceyl. iii. 76. *C. acuminatum*, Roxb. Fl. Ind. i. 599. The Star Apple. Vern. *Petakara*, Beng.; *Pithogarkh*, Ass.; *Hali*, Kan.; *Tarsi*, *dongrima*, Mar.; *Kat illupai*, Tam.; *Pala*, Mal.; *Lawulú*, Cingh.; *Thankya*, Burm.

An evergreen tree. *Wood* white, close-grained, moderately hard. *Pores* small, in radial lines bending into oblique strings. *Medullary rays* numerous, very fine.

Evergreen forests of Assam, the Khasia Hills, Sylhet, Pegu, the Western Gháts and Ceylon.

Weight, according to A. Mendis, 39 lbs. per cubic foot; Kyd gives weight 40·5 lbs. and P = 780; Bourdillon gives weight 36 lbs., P = 476. The wood is used for building, and said by Bourdillon to be useful for shingles. The fruit is edible.

	lbs.
W 4580. Travancore (Bourdillon)	33

NOTE.—In Ed. 1 the wood was described from A. Mendis' No. 48 (*Sideroxylon* sp., 39 lbs.), which was doubtless correct; but in the new box his No. 82 (*Chrysophyllum Roxburghii*, 39 lbs.) is some other wood altogether, probably some species of ANONACEÆ.

In Nordlinger's Sections, vol. 5, is a section of the wood of *Chrysophyllum Cainito*, Linn., the "Star-apple" of the West Indies, often cultivated in the hotter parts of India. The *wood* is light brown, soft. *Pores* moderate-sized, subdivided or in radial and oblique short strings. *Medullary rays* fine, wavy. Very fine transverse lines across the spaces between the rays.

2. SARCOSPERMA, Hook. f.

Two species. *S. Griffithii*, Benth.; Fl. Br. Ind. iii. 536, is a large tree of the Khasia and Jaintia Hills.

1. S. arboreum, Benth.; Fl. Br. Ind. iii. 535; Gamble Darj. List 53. Vern. *Pahar lampati*, Nep.; *Kilyatzo*, Lepcha.

A large evergreen tree. *Bark* light reddish-brown, thin. *Wood*

pink, moderately hard. *Pores* moderate-sized, in long, wavy, radial lines. *Medullary rays* very numerous, fine, equidistant, the distance between two rays much less than the diameter of the pores. Indistinct concentric linés.

East Himalaya, in Sikkim up to 4000 ft.; Khasia and Patkoye Hills of Assam.
A handsome tree. The wood used to be employed in Sikkim to make dug-out canoes.

		lbs.
E 3316.	Chenga Forest, Darjeeling (Gamble)	30

3. SIDEROXYLON, Linn.

About seven species. *S. grandifolium*, Wall.; Fl. Br. Ind. iii. 536; Kurz For. Fl. ii. 117; Vern. *Thattabat*, *tawthabut*, Burm., is a large tree of the Khasia Hills, Sylhet and the hills of Martaban. *S. ferrugineum*, Hook. and Arn.; Fl. Br. Ind. iii. 537 (*S. attenuatum*, A. DC; Kurz For. Fl. ii. 117), is an evergreen small tree of Tenasserim. *S. Hookeri*, Clarke and *S. Gamblei*, Clarke are trees of the Sikkim Himalaya at 5–6000 ft.; and *S. assamicum*, Clarke is a grey-barked tree of Assam and Cachar. *S. burmanicum*, Coll. and Hemsl. in Journ. Linn. Soc. xxviii. 82, is a tree of the Shan Hills at 3–4000 ft. *S. longepetiolatum*, King and Prain in Ann. Calc. ix. 50 (*Gluta longepetiolata*, Kurz For. Fl. i. 310), is a large tree of Tenasserim, the Andamans and Narcondam Island.

1. **S. tomentosum**, Roxb. Fl. Ind. i. 602; Fl. Br. Ind. iii. 538; Kurz For. Fl. ii. 116; Talbot Bomb. List 119; Trimen Fl. Ceyl. iii. 77. *Achras elengioides*, DC; Bedd. Fl. Sylv. t. 235. Vern. *Kanta bohul, kontaboro*, Uriya; *Palei, mul-makil*, Tam.; *Holay*, Badaga; *Hudigolla, kumpoli*, Kan.; *Kumbul, kanta kumla*, Bombay.

A small, often thorny tree. *Bark* light reddish-brown, thin, much cracked. *Wood* light yellowish-brown, moderately hard (plains specimens) to hard (hills specimens). *Pores* fine (hills) to moderate-sized (plains), in groups in short lines usually oblique, the groups somewhat far apart and in echelon. *Medullary rays* very fine, very numerous, equidistant. Very numerous, very fine faint lines across the rays, irregular.

There are two well-marked forms of this plant: (1) the plains form with rather large leaves, common in the forests of Orissa, the Circars and Deccan; (2) the hills form common in the sholas of the Nilgiris and other S. Indian hill ranges at 6–7000 ft. It is probably the former form that is found in the dry forests of Burma and N. Ceylon.

Beddome says the wood makes beams for houses and good carpenters' planes. The fruit is eaten in curries and made into pickles. Weight about 56 lbs. per cubic foot.

		lbs.
C 3504.	Khurdha Forests, Orissa (Gamble)	—
C 3819, 3935.	Gullery Forests, Ganjam (Gamble)	52 and 58
W 3864.	Ootacamund, Nilgiris, 7000 ft. „	59

4. ISONANDRA, Wight.

Six or seven species, all of Southern or Western India or Ceylon, difficult to distinguish, and by some writers combined. Were it not that the woods differ from each other a good deal, I should have been inclined to consider both the trees whose woods are described as one species, as I never was able satisfactorily to recognize them apart in the forest; and even now I am by no means sure that the identifications are correct. But the specimens are undoubtedly from Nilgiri *Isonandras*. *I. Stocksii*, Clarke; Fl. Br. Ind. iii. 539; Talbot Bomb. List 119, is a tree of the Konkan. *I. lanceolata*, Wight; Fl. Br. Ind. iii. 539; Trimen Fl. Ceyl. iii. 77 (part); Vern. *Kiriwerala, molpedda*, Cingh., is a tree of the hills of South India and Ceylon. According to Trimen, it also includes *I. Wightiana*, A. DC; Fl. Br. Ind. iii. 539.

1. **I. Candolleana**, Wight; Fl. Br. Ind. iii. 539. *Bassia Wightiana*, DC; Bedd. Fl. Sylv. cxli. (in part).

A tree. *Bark* brown. *Wood* light reddish-brown, hard, close-

grained. *Annual rings* marked by a dark line without pores. *Pores* moderate-sized, in straight radial strings of 4 to 5, rather distant and obliquely echeloned. *Medullary rays* fine, regular. Transverse lines very faint.

Sholas of the Nilgiri Hills at 5–8000 ft.

A favourite wood of the Todas, used by them for the door-panels of their huts. A useful timber.

		lbs.
W 4126, 4081.	Cairn Hill, Nilgiris, 7000 ft. (Gamble)	48

2. **I. Perrottetiana,** Wight; Fl. Br. Ind. iii. 539. *Bassia Wightiana*, DC; Bedd. Fl. Sylv. cxli. (in part).

A tree. *Bark* brown, rough. *Wood* light reddish-brown, hard, close-grained. *Pores* small to moderate-sized, in narrow groups which are somewhat radially but obliquely arranged, and often fork. *Medullary rays* fine, regular. Transverse lines clear and conspicuous, regular and wavy.

Sholas of the Nilgiri Hills at 5–7000 ft.

A fine wood, harder and heavier than that of the preceding, and used for the same purposes.

		lbs.
W 4127.	Nilgiri sholas, 7000 ft. (Gamble)	58

5. DICHOPSIS, Thw.

Ten species, seven of which are of Ceylon only, and of these six are rare species, the seventh being *D. grandis*, Benth., whose wood is here described.

D. Gutta, Benth.; Fl. Br. Ind. iii. 543, of the Straits Settlements and the Malay Archipelago, is the chief tree which gives the "Gutta-percha" of commerce, one of the most important of the forest products of the East. The method of collection, usually employed by the natives of the Malay Peninsula, is very simple but very wasteful. The tree is felled, and either the bark is stripped off altogether or rings are cut at intervals of about a foot. The sap that oozes out is then collected, put in a pot and boiled with a little water, which prevents its hardening afterwards when exposed to the air. It is then run into moulds. The trees usually chosen are those of about thirty to thirty-five years old, and each tree gives 2 to 3 lbs. of gutta. Such a system is naturally a wasteful one, and if regularly continued without any arrangements for reproduction would probably lead to the exhaustion of the supply, so that it is satisfactory that French experts are said to have discovered that the gutta-percha can be obtained from the leaves without felling the tree. However this may be, there is little doubt of the value of the product, and that if it is to be regularly produced the tree must be grown in plantation and systematically worked.

In his "Report on the Forest Administration of the Federated Malay States, 1900," Mr. H. C. Hill says, "So far as can be ascertained from the leaves, *Palaquium* '(Dichopsis) *Gutta*, Burck. and *P. oblongifolium*, Burck., which are not easily dis-'tinguished the one from the other, but which differ in a marked way from all other 'species, are widely distributed, growing in the plains and up to 2500 ft. in the hills. 'These yield the best quality of gutta-percha, valued at 15 dollars per 4 lbs. Growing 'throughout the same zone, but more rarely in the plains than in the hills, is another 'species." He recommends, both in those States and in the British territories, the formation of plantations in suitable localities, with *Fagræa fragrans* (*Tembusu*) and *Afzelia palembanica* (*Marbau*) as nurses; and advises experiments being made to ascertain the most economical method of obtaining the gutta-percha with the least damage to the crop of trees.

Wood red, moderately hard. *Pores* moderate-sized, in radial echeloned strings. *Medullary rays* fine, numerous. Transverse concentric lines numerous, wavy.

1. **D. grandis,** Benth.; Fl. Br. Ind. iii. 540. *Bassia grandis*, Bedd. Fl. Sylv. t. 254. *Palaquium grande*, Engler; Trimen Fl. Ceyl. iii. 82. Vern. *Kirihiriya, mihiriya, kirihembiliyā*, Singh.

A large tree. *Bark* thick, brown. *Wood* red, moderately hard.

Pores moderate-sized grouped in radial strings of 1 to 5 pores, the strings echeloned at some distance. *Medullary rays* fine, numerous, several between each string of pores. Transverse lines wavy, very fine.

Moist region of Ceylon at 3–5000 ft.

A. Mendis says that the wood is used for roofs and other works in the building of bungalows and store-houses on coffee (tea) estates.

Ceylon Collection (new), Nos. 71, 92 (Mendis).

2. **D. elliptica**, Benth.; Fl. Br. Ind. iii. 542; Talbot Bomb. List 119. *Bassia elliptica*, Dalz.; Bedd. Fl. Sylv. t. 43. Vern. *Panchoti, palla*, Mar.; *Kat illupei*, Tam.; *Pála*, Mal.; *Kei pála*, Trav. Hills; *Pauchonta*, Kan.; *Illupei*, Kader.

A very large tree. *Wood* reddish-brown, moderately hard, durable. *Pores* moderate-sized to large, in oblique or echeloned strings. *Medullary rays* fine, numerous, often 2 to 3 to each group of pores. Concentric bands of light tissue numerous, wavy.

Forests of the Western Gháts from N. Kanara southwards, ascending to 4000 ft.

This tree often grows to a height of 100 ft. with a straight bole. It gives a second-rate quality of "Gutta-percha," collected by tapping the living tree; but although this substance can be utilized for waterproofing and cement, it is not a complete substitute for the proper article. Possibly experiments in its treatment might tend to improve its value. Bourdillon gives W = 44 lbs., P = 472, and says the wood is good for shingles.

		lbs.
W 3989.	Wynaad, Malabar (Brougham)	45
W 4546, 4606.	Travancore (Bourdillon)	40 and 46

3. **D. polyantha**, Benth.; Fl. Br. Ind. iii. 542. *Isonandra polyantha*, Kurz For. Fl. ii. 119. Vern. *Tali*, Beng.; *Sill-kurta*, Cachar; *Thainban*, Magh.

A moderate-sized evergreen tree. *Wood* red, hard. *Pores* moderate-sized, in wavy radial lines, sometimes slightly oblique. *Medullary rays* very fine, not prominent. Fine, wavy, parallel and equidistant concentric lines.

Cachar, Chittagong, Arracan and Pegu.

The wood of this tree is much valued in Cachar and Chittagong. Mann says it does not float, but he must refer to green wood. Kurz says it yields a good quality of gutta-percha in large quantity. Major Lewin says it is used in Chittagong for making beds, tools, etc., and is sawn into boards for the Calcutta market. Weight 53 lbs. per cubic foot.

		lbs.
E 1274.	Cachar	53
E 1494.	Sylhet	—
E 1952.	Chittagong (Chester)	53
E 3285.	Rinkheong Reserve, Chittagong (Gamble)	—
E 3691.	Chittagong Hill Tracts (Gamble)	52

Nordlinger's Sections, vol. 10.

6. BASSIA, Linn.

Ten species. Four of these are endemic Ceylon plants, viz. *B. neriifolia*, Moon; Vern. *Gan-mi*, Cingh., *B. fulva*, Bedd.; Vern. *Wana-mi*, Cingh., *B. Moonii*, Bedd., and *B. microphylla*, Hook. all Fl. Br. Ind. iii. 545; Bedd. Fl. Sylv. cxl.; Trimen Fl. Ceyl. iii. 79–81. Only the first is common: they are all inhabitants of the moist low country. *B. Lobbii*, Clarke; Fl. Br. Ind. iii. 546, is a tree of the Attaran Valley in Burma, and *B. caloneura*, Kurz; Fl. Br. Ind. iii. 546 (*Isonandra caloneura*, Kurz For. Fl. ii. 119), is a common tree of the Andamans.

B. Parkii, Don, is the tree which gives the "Shea butter" in West Africa, first described by Mungo Park and said by him to be a main article of commerce and to be an excellent food, for "besides the advantage of its keeping the whole year without 'salt, it is whiter, firmer, and, to my palate, of a richer flavour, than the best butter 'I ever tasted made of cow's milk."

Wood hard, smooth, durable, usually with red heartwood. *Pores* small and moderate-sized, in short radial or oblique lines, more or less

in echelon. ***Medullary rays*** **numerous, fine, equidistant, joined by fine transverse bars.**

1. B. latifolia, Roxb. Fl. Ind. ii. 526; Fl. Br. Ind. iii. 544; Bedd. Fl. Sylv. t. 41; Brandis For. Fl. 289; Talbot Bomb. List 120. *B. villosa,* Wall.; Kurz For. Fl. ii. 122. Vern. *Mahwa, mowa, mahúa,* Hind.; *Mahwa, mahúla, maul,* Beng.; *Moha, moholo,* Uriya; *Matkom,* Sonthal; *Mohul,* Mal Pahari; *Mandukam,* Kól; *Mohúl,* Bhumij; *Irpi,* Khond; *Mahu,* Baigas; *Irúp, irrip, irhu,* Gondi; *Mohu,* Kurku; *Mohwa, moho,* Mar.; *Ippa, pedda ippa, yeppa,* Tel.; *Illupei, elupa, kat illippi,* Tam.; *Ippi, honge,* Kan.; *Poonam,* Mal.; *Kanzaw,* Burm.

A large deciduous tree. *Bark* ½ in. thick, grey, with vertical cracks, exfoliating in thin scales. *Wood* from hard to very hard: sapwood large; heartwood reddish-brown. *Annual rings* indistinct. *Pores* moderate-sized, often subdivided, not numerous, in short, radial, wavy lines more or less in echelon. *Medullary rays* numerous, fine. Numerous parallel, fine, transverse bars.

Deciduous forests of Central India; in the C.P., Berar, Khandésh, Guzerat, the Konkan, Chota Nagpore, Orissa, the Circars and Deccan, extending north to the forests of Oudh, Kumaon and Dehra Dún at the foot of the Himalaya and south-west to North Kanara; forests of Upper Burma. Much cultivated, and where cultivated frequently found self-sown.

One of the most important of Indian forest trees, not so much on account of its excellent timber as for its corollas, which are fleshy and sweet, and are an important article of food in the Central Indian forest tracts. They are eaten either raw, or cooked, or made into sweetmeats; they can be used for making sugar, and a coarse spirit of unpleasant odour, so marked that the presence of a still can be detected at long distances, is prepared from them. When eaten, the flowers are mixed with other food or with *Sál* seeds or leaves of other plants. The average yield of a tree, according to Mr. L. R. Forbes of Palamow, is about 2½ maunds, and the flowers collected sell at about 12 annas a maund. Properly prepared, they are pleasant to eat, tasting somewhat like pressed figs. To collect the flowers, a clean space is swept under the tree and the flowers collected as they fall. Bears, deer, and other animals are also fond of them, and may be shot under trees which they frequent. The spirit distilled from the flowers is largely used, and has been the subject of special abkari regulations in some provinces. The fruit, ripe or unripe, is also valuable. The outer coat is eaten, raw or cooked, as a vegetable, the inner one dried and ground into meal; while from the kernel a greenish-yellow oil or butter is obtained, largely used by jungle tribes or sold for soap-making. The oil solidifies at a low temperature, and melts at 110° F., but in a hot climate soon becomes rancid. For further information on the important uses of the tree, see Watt, Dict. Econ. Products, vol. i. 406.

The wood is not much used, as the tree is so useful for its flowers and fruit that it is rarely cut for timber, but it gives good house-posts out of saplings, and the seasoned wood is used in house-building, for furniture and country vessels, the naves of wheels, etc. An analysis of the ash of the wood showed that 100 lbs. steam-dry clean wood gave 1·45 lbs. of ash, the chief constituents being soluble potassium and sodium compounds, with but little carbonate of lime.

The weight and transverse strength of the wood have been determined by the following experiments:—

Experiment by whom made.	Year.	Wood whence procured.	Weight.	No. of experiments.	Size of bar.	Value of P.
			lbs.		ft. in. in.	
Cunningham . .	1854	Gwalior	68	1	2 × 1 × 1	715
Skinner, No. 22 .	1862	South India	66	—	—	760
Fowke . . .	1859	—	63	—	—	585
R. Thompson . .	1868	Central Provinces	58	—	—	—
List	1873	" "	66	—	—	—
H. H. O'Connell .	1886	Coimbatore	59	—	—	$s = 0·0116$
Specimens examined	1878–99	Various	62	—	—	—

The average weight may be taken at 62 lbs. per cubic foot.

In the forests the *Mahua* tree reproduces well, and it is easy to propagate artificially if the seeds are sown when fresh. Being oily they will not keep long. They are best sown at site. The tree is often planted in avenues, and though then useful to the ryots for the flowers and fruit, it is liable to make a considerable mess in the road. It is very frequently planted in topes, either alone or mixed with mango. In preparing working plans for forests in which the Mahua occurs, it is necessary in general to provide for protection of the older and best-bearing trees independently of their timber value. As the flowers appear in the hot season, special precautions have to be taken to obviate damage to the forests by fire when the collectors are at work, or shikaris about.

		lbs.
O 266.	Garhwal (1868)	60
O 1493.	Kheri, Oudh	65
H 2969.	Kumaon, 5000 ft.	66
C 827.	Bairagarh Reserve, Berar (Drysdale)	69
C 2771.	Melghát, Berar (Brandis)	—
C 1116.	Ahiri Reserve, Central Provinces (R. Thompson)	60
C 2731.	Moharli Reserve, Central Provinces (young) (Brandis)	52
C 1243.	Gumsúr, Madras (Dampier)	63

Nordlinger's Sections, vol. 10 (Tab. IX. 4).

2. **B. longifolia,** Willd.; Fl. Br. Ind. iii. 544; Roxb. Fl. Ind. ii. 523; Bedd. Fl. Sylv. t. 42; Brandis For. Fl. 290; Talbot Bomb. List 120; Trimen Fl. Ceyl. iii. 79. Vern. *Ippa, yeppa, sanna ippa, pinna,* Tel.; *Moha,* Mar.; *Illupei, kat illupei, elupa,* Tam.; *Ippi, hippe,* Kan.; *Ellupi,* Mal.; *Mi,* Cingh.; *Mèzè,* Burm.

A large evergreen tree. *Bark* dark yellowish-grey, thick, slightly furrowed. *Wood* red, moderately hard, close-grained. *Pores* small to moderate-sized, in short radial or oblique echeloned strings. *Medullary rays* numerous, fine, uniform, equidistant, bent round the pores. Transverse bars fine, irregular, wavy.

Western and Southern India from the Konkan southwards; more usually met with in plantations; dry region of Ceylon; cultivated only in Burma.

This species replaces *B. latifolia* in South India, and its flowers and fruit are used in the same way and for the same purposes. The flowers are eaten, and are used for the distillation of spirit; the fruit is partly eaten, partly used for the extraction of oil, partly as soap. The tree gives an inferior gum, scarcely used except in medicine. The wood is similar to that of *B. latifolia,* but is usually not quite so heavy. Beddome says it is "heavy, close- and straight-grained, very flexible and durable, valued for ships' 'keels and for planking below the water-line, makes good trenails and is used in the 'construction of carts and for bridges." The weight of the wood, according to Skinner, No. 20, is 60 lbs.; A. Mendis gives 61 lbs. Skinner gives P = 730, Mendis 724. The tree is much planted in avenues and topes, even in the dry Deccan country.

	lbs.
No. 53 (old), 93 (new), Ceylon Collection (Mendis)	61

3. **B. malabarica,** Bedd. Fl. Sylv. cxl.; Fl. Br. Ind. iii. 544; Talbot Bomb. List 120. Vern. *Att-illupei,* Tam.

A large tree. *Wood* dark red, hard. *Pores* moderate-sized, in short radial or slightly oblique strings of 6 to 8. *Medullary rays* fine, numerous. Transverse bars very fine, very numerous, wavy.

Western Coast and hills of the Western Ghâts, along streams from Kanara to Travancore, in the Anamalais up to 4000 ft.

	lbs.
W 4669. Travancore (Bourdillon)	43

4. **B. butyracea,** Roxb. in As. Res. viii. 499, Fl. Ind. ii. 527; Fl. Br. Ind. iii. 546; Brandis For. Fl. 290, t. 35; Gamble Darj. List 53. Vern. *Fulwa, phulwara,* Hind.; *Chiúra, chaiúra, phulel,* Kumaon; *Cheuli,* Oudh; *Chúri,* Nep.; *Yel, yelpote,* Lepcha.

A large deciduous tree. *Bark* ½ in. thick, dark grey. *Wood* light brown, hard. *Annual rings* marked by a dark line. *Pores* moderate-

sized to large, in radial lines of different length. *Medullary rays* numerous, fine, equidistant. Transverse bars fine.

Sub-Himalayan tract from the Ganges (Tapoban forest) to Bhutan, at 1–5000 ft.; Gonda forests of Oudh.

Mr. Gott's account of this tree, quoted by Roxburgh, says that the wood is white, soft and porous, nearly as light as that of *Semul* (*Bombax malabaricum*), but the specimen described does not bear this out. The growth is fast, 3 to 4 rings per inch of radius. Mr. Gott says that the tree prefers the slopes of the hills near Almora with a south aspect, but what I have met with in the Ganges Valley and in Sikkim grew in valleys in fairly shady places. The pulp of the fruit is eaten, and from the seeds a vegetable butter is extracted, of the consistence of fine lard and of a white colour. It does not melt under 120° and keeps a long time without deteriorating. It makes good soap, and is useful for candles, as it is said to burn without smoke or unpleasant smell. When perfumed, it is used as an ointment and as an external application for rheumatism. Duthie says it is an excellent application for chapped hands. The flowers are not eaten. The bark is used in Sikkim to poison fish.

		lbs.
E 622.	Bamunpokri, Darjeeling (Bonham-Carter) . . .	52
E 4895.	Bengal	40 (young tree)

No. W 4730, sent by T. F. Bourdillon from Travancore, is said by him to belong to a new species shortly to be described. It has a pink *wood*, paler and softer than that of other species. *Pores* moderate-sized to large, in short radial strings of 1 to 4, echeloned at fairly regular distances. *Medullary rays* fine, regular and prominent. Transverse bands prominent, more regular and more concentric than in other species. Weight 51 lbs. per cubic foot.

7. PAYENA, A. DC.

Two species. *P. paralleloneura*, Kurz For. Fl. ii. 121; Fl. Br. Ind. iii. 548, is an evergreen tree of the tropical forests of Martaban and Tenasserim.

1. P. lucida, A. DC; Fl. Br. Ind. iii. 547; Kurz For. Fl. ii. 121. *Isonandra polyandra*, Wight Icon. t. 1589. Vern. *Dolu-kurta*, Cachar.

An evergreen tree. *Wood* red, hard. *Pores* moderate-sized, in short radial lines. *Medullary rays* very fine, very numerous, uniform, equidistant. Numerous parallel, wavy, concentric lines, not very prominent.

Cachar, Tenasserim (?).

The wood is used for planking.

		lbs.
E 1275.	Cachar (Mann)	45

8. MIMUSOPS, Linn.

Five species. *M. Roxburghiana*, Wight; Fl. Br. Ind. iii. 548; Bedd. Fl. Sylv. cxliii.; Brandis For. Fl. 293; Vern. *Kanupala*, Tam.; *Renga*, Kan., is a large tree found by Wight in the forests of the hills of Coimbatore. Beddome says it is common in the forests at the foot of the Nilgiri and Anamalai Hills, and Bourdillon that it is found in the evergreen forests of Travancore at 2–5000 ft., and has a strong red wood. Beddome, evidently quoting Skinner's No. 96, *M. indica*, Vern. *Palava*, Tam., gives W = 48 lbs., and P = 845, and says that the wood is reddish-brown, rather coarse-grained, but strong, durable, and easily worked; and that it is used for house-building and gunstocks. *M. Kauki*, Linn.; Fl. Br. Ind. iii. 549, is a large tree of the Straits Settlements and Malay Archipelago found as far north as Amherst in Burma, and frequently cultivated in India as at Calcutta and Madras and even in the Punjab. It has an edible fruit, which the Goanese call "Poma d'Adao," or "Adam's apple," and which somewhat resembles the fruit of the *Bér*. It is also said to give a kind of gutta-percha.

Evergreen trees. *Wood* red, very hard. *Pores* small, in short radial or oblique lines. *Medullary rays* very fine, very numerous, uniform and equidistant. Numerous wavy, concentric lines.

1. M. Elengi, Linn.; Fl. Br. Ind. iii. 548; Roxb. Fl. Ind. ii. 236; Bedd. Fl. Sylv. t. 40; Brandis For. Fl. 293; Kurz For. Fl. ii. 123; Talbot Bomb. List 120; Trimen

Fl. Ceyl. iii. 86. Vern. *Bukal, bohl,* Beng., Mar.; *Mulsári, maulser,* Hind.; *Khiri, kirakuli,* Uriya; *Pál,* Palkonda; *Magadam, mahila, makil, mukalai, vilva-pattiri,* Tam.; *Pogada,* Tel.; *Bokal, boklu, mugali, bokli, renje, bagalamara,* Kan.; *Barsoli,* Meywar; *Vavoli, ovalli, owli,* Mar.; *Elengi,* Mal.; *Kaya, chaya,* Burm.; *Munamal,* Cingh.

A large evergreen tree. *Bark* dark grey, rough, deeply cracked with vertical and transverse fissures. *Wood* very hard, close- and even-grained: sapwood reddish-brown; heartwood dark red. *Pores* small in short lines, which are generally radial, but often irregular and oblique. *Medullary rays* very fine, very numerous, uniform and equidistant. Many parallel, wavy, concentric bands, narrow but conspicuous.

Forests of South India, from the Northern Circars on the east and the Konkan on the west, southwards; Shan Hills, Martaban and Tenasserim in Burma; Andaman Islands; low country of Ceylon: much cultivated elsewhere.

This fine tree is to be found on the eastern side of India in the dry evergreen forests as a rather small tree, on the western side in the wet evergreen forests as a "very large tree" (Talbot). It is, perhaps, best known in cultivation, and its flowers, which, especially in Burma, when the tree is in full bloom, fall off in showers, are used to make garlands and to distil for perfume. The bark is much sought after for native medicinal uses, and trees are frequently stripped clean. There was one solitary tree on the roadside at Dehra Dún, in good condition some 8 years ago, but by degrees it has been so stripped as to be now dead or nearly so, and the same may be said of a neighbouring *M. hexandra,* which was completely killed.

The wood is strong, durable, of good colour and quality, but heavy. Beddome says it is used for house-building, carts and cabinet-work. Skinner, No. 94, gives W = 61 lbs., P = 632; Wallich gives W = 46 lbs.; A. Mendis 68 lbs.; Heinig (Andamans) 60 lbs.; the specimens here enumerated 60 lbs., omitting that from Salem, which is extraordinarily heavy. Logs exported from the Andamans square up to 25 ft. with up to 1 ft. of siding. Graham Anderson says that in Mysore it is used in preference to other woods for rice-pounders. It is an excellent fuel. The fruit is eaten, and the seeds give an oil which is used in cooking, for lighting and in medicine. The tree is one of the best of the woods in the dry Carnatic evergreen forests, as is *M. hexandra;* indeed, *pála* and *pogada* may be said to be the best of the woods in the forests of the laterite hills of Nellore and adjoining similar districts. It seems to reproduce well in shade, and to remain small until an opportunity offers for removal of the cover, when it grows up at once.

	lbs.
W 1223. North Kanara (Barrett)	62
W 5002. Coondapur, S. Kanara (C. Hammond)	54 (young tree)
D 1073. North Arcot (Beddome)	—
B 2224, 2241. Andaman Islands (Col. Ford, 1866) . .	60 and 58
No. 56 (old), 97 (new), Ceylon Collection (Mendis) . . .	61
No. 13, Salem Collection (marked *Bassia longifolia*) . . .	87

2. **M. hexandra,** Roxb. Fl. Ind. ii. 238; Fl. Br. Ind. iii. 549; Bedd. For. Fl. cxli.; Talbot Bomb. List 120; Trimen Fl. Ceyl. iii. 86. *M. indica,* A. DC; Brandis For. Fl. 291. Vern. *Khir, khirni,* Hind.; *Rain,* Meywar; *Khiri, kirakuli,* Uriya; *Ranjana, raini, khirni,* Mar.; *Raini,* Gondi; *Pála, palle panlo, palla pandu,* Tel.; *Palla, kanun palle, palai,* Tam.; *Pal,* Palkonda; *Palu,* Cingh.

A large or small evergreen tree. *Bark* grey, smooth, when young often studded with branchlets and clusters of leaves which degenerate into hard, conical, thorn-like protuberances. *Wood* red, very hard, close- and even-grained; in Ceylon "dark vinous-red to purplish-black" (Broun). *Pores* small, scanty, occasionally solitary but usually in short radial lines which are echeloned at distances in slanting fashion. *Medullary rays* very numerous, fine, uniform, equidistant. Transverse lines wavy, irregular, less prominent but broader than in *M. Elengi.*

Dry forests of the Deccan, Circars, Orissa and the Carnatic extending north to the Pachmarhi Hills of the C.P. and west to the Mahratta country; dry region of Ceylon (see map at p. 370, Ind. For., xxvi.); much cultivated elsewhere.

As has already been mentioned under *M. Elengi,* this is one of the chief trees of

the dry evergreen forests, especially in the Carnatic, on sandstone and laterite, frequently also inland where it is associated with Satinwood, Ebony, *Hardwickia binata* and *Buchanania angustifolia*. In the forests of Ceylon it is of greater importance than it is in India. An excellent account of it is given by A. F. Broun in Ind. For. xxvi. 370, from which it appears that the forests are found chiefly in the northern half of the island and in a belt along the East Coast. Palu prefers a sandy loam, but is found also on sand, gravelly soil and clayey loams. Broun further says that in good soil it reaches 100 ft. in height with a 40 to 50 ft. bole and 14 to 15 ft. in girth, dimensions which, so far as I know, are never reached in India; also that it may reach a girth of 6 ft. at breast height when about 130 years old, and continue vigorous up to 8 ft. in girth. It seems to require plenty of light overhead with some ground protection for good seed-reproduction. Its chief valuable associates in Ceylon, as in India, are Ebony and Satinwood, and to these may be added *Berrya Ammonilla*, *Alseodaphne semecarpifolia* and *Vitex altissima*.

In India the bark is often stripped for use in medicine, the fruit is eaten and the seeds give an oil. The wood is hard, tough, close-grained and durable; it is used for sugar-mill beams, oil-presses, house-posts, tool-handles, and turnery. Skinner, No. 95, gives W = 70 lbs., P = 944; Broun gives W = 69·9 lbs.; Mendis gives W = 68 lbs., P = 1052, the specimens here enumerated give an average of W = 65 lbs. The wood is an excellent fuel and is one of the chief products of the scrub forests of the Carnatic districts.

Broun says that in Ceylon it is found best to girdle the trees two or three years before they are felled, so as to obviate the tendency of the wood to split in seasoning. He remarks that the timber is very durable, and quotes the gates of the Kalpitiya fort which were still sound after 135 years; and the piles at Mannar which were sound below water at 100 years of age. The great weight and hardness are against its much extended use as timber, but Broun mentions several instances of its very successful employ in decorative house-fittings and furniture.

		lbs.
C 3551.	Khurdha Forests, Orissa (Gamble)	72
C 4465.	Chanda, C.P. (Lowrie)	—
D 3936.	Cuddapah Forests (Higgens)	62
D 1283.	Anamalai Hills (Beddome)	60
No. 65 (old), 107 (new), Ceylon Collection (Mendis)	. . . . .	68

3. **M. littoralis**, Kurz For. Fl. ii. 123; Fl. Br. Ind. iii. 549. *M. indica*, Kurz And. Report; Brandis For. Fl. 292. Andaman Bullet Wood. Vern. *Katpali*, Burm.; *Dogola*, *mowha*, And.

A large evergreen tree. *Bark* thin, smooth, dark brown. *Wood* red, smooth, very hard and close-grained. *Pores* very small, elongated, subdivided, in radial or oblique echeloned lines. *Medullary rays* very fine, very numerous, uniform and equidistant. Transverse lines numerous, but faint.

Coast forests of the Andaman, Coco and Nicobar Islands; in the Andamans, forming nearly pure forests on the level lands behind the beach and the mangrove swamps.

The weight and transverse strength have been determined by the following experiments:—

Experiment by whom conducted.	Year.	Wood whence procured.	Weight.	No. of experiments.	Size of bar used.	Value of P.
			lbs.		ft. in. in.	
Brandis	1864	Andamans	67	7	6 × 2 × 2	748
"	"	"	66	7	6 × 2 × 1½	963
"	"	"	68	11	2 × 1 × 0¾	1091
"	"	"	71	5	2 × 1 × 1	779
"	1865-66	"	65	3	6 × 2 × 2	981
"	"	"	64	1	6 × 2 × 1½	1090
"	"	"	68	8	2 × 1 × 0¾	1266
Bennett	1872	"	66	—	—	1128
Smythies	1878	"	72	3	—	—

The wood is handsome, it is close-grained and durable, but apt to split. It is used in the Andamans for bridges and house-posts, and Col. Ford (1866) said it had been sent to Calcutta to be tried for sleepers. He also says the bark is used to give a red dye. It is a fine tree with a fine timber which is extracted in squares up to 50 ft. long with a siding of 2 ft. It is seasoned by girdling, and is not eaten by white ants or xylophagous insects, but is not proof against teredo. It is difficult to cut and saw or to drive nails into.

		lbs.
B 513.	Andaman Islands (Gen. Barwell)	41
B 2212.	" " (Col. Ford, 1866)	75
B 2497.	" " (Home, 1874, No. 6)	72

ORDER LXVIII.—EBENACEÆ.

Two Indian genera: Maba and Diospyros, the latter a very large one containing the different species of Ebony. Several of these are of importance in India and Ceylon; and though the export of ebony from the forests of India is now quite small, there is still a considerable trade done from Ceylon. The chief kinds known to the market are "Ebony," the produce of two or three different trees, "Calamander Wood" and "Andaman Marble-wood."

Wood usually black or grey, sometimes reddish or white. *Pores* small to moderate-sized, scanty, often in short radial lines which are distant and somewhat in echelon. *Medullary rays* fine, usually numerous. Transverse bars sometimes absent, usually frequent and occasionally conspicuous as concentric wavy lines. The SAPOTACEÆ are distinguished from EBENACEÆ by having usually red or yellow wood, longer radial lines of pores and more conspicuously oblique arrangement.

1. MABA, Forst.

Eight species, three of which are endemic Ceylon trees. Of these, only one, *M. oblongifolia*, Hiern; Fl. Br. Ind. iii. 551; Trimen Fl. Ceyl. iii. 89 (*Macreightia oblongifolia*, Thw.; Bedd. Fl. Sylv. cxlvii.); Vern. *Kalu-médiriya*, Cingh., is fairly common. *M. micrantha*, Hiern; Fl. Br. Ind. iii. 552; Talbot Bomb. List 121 (*Holochilus micranthus*, Dalz.; Bedd. Fl. Sylv. cxlvii.), is a small tree of the Bombay Ghâts. *M. merguensis*, Hiern; Fl. Br. Ind. iii. 552; Kurz For. Fl. ii. 138, is a small tree of the forests of Mergui.

1. M. buxifolia, Pers.; Fl. Br. Ind. iii. 551; Bedd. Fl. Sylv. cxlviii.; Kurz For. Fl. ii. 139; Trimen Fl. Ceyl. iii. 89. *Ferriola buxifolia*, Willd.; Roxb. Fl. Ind. iii. 790. Vern. *Guakoli*, Uriya; *Alli, uti, yerruti, chinua ulinji*, Tel.; *Iramballi, eruvalli, humbilli, juvarai, irampalai*, Tam.; *Pisinika, gulugu*, Palkonda; *Kalu-habaraliya*, Cingh.; *Mèpyaung*, Burm.

A small evergreen tree. *Bark* thin, grey to black. *Wood* grey with darker streaks, hard, close-grained. *Pores* small to moderate-sized, scanty, in radial or slanting or echeloned strings of usually 4 to 5. *Medullary rays* very fine, very numerous, the distance between them equal to the diameter of the pores. Transverse pale wavy bands numerous and regular.

Orissa, N. Circars, Deccan and Carnatic, in dry evergreen forest or along water-courses frequently dry; dry region of Ceylon; Upper Tenasserim in Burma.

A common shrub or small tree reaching a height of 30 ft. and a girth of 2 ft., characteristic of the scrub forests on sandstone or laterite on the Coromandel coast.

		lbs.
C 3502.	Khurdha Forests, Orissa (Gamble)	—
C 3954.	Rekapalle Forests, Upper Godavari (Gamble)	58

2. M. andamanica, Kurz For. Fl. ii. 140; Fl. Br. Ind. iii. 551.

An evergreen shrub. *Wood* bluish-grey. *Pores* small, in short

radial or oblique lines. *Medullary rays* very fine, close, wavy, regular. Numerous wavy transverse lines.

Upper mixed forests of the Andaman Islands.

	lbs.
B 2472. Andamans (Kurz, 1866)	49

3. **M. nigrescens,** Dalz.; Fl. Br. Ind. iii. 551; Talbot Bomb. List 121. Vern. *Raktarohida, raktarora,* Mar.

A tree. *Bark* grey, rough with rounded tubercles, breaking off in thick rounded pieces and showing a nearly black under-surface. *Wood* greyish-brown, hard, with very fine numerous wavy regular concentric lines of soft tissue; heartwood (?) somewhat darker than sapwood. *Pores* small to moderate-sized, scanty, in oblique lines. *Medullary rays* very fine, very numerous, regular.

Evergreen forests of the Konkan and N. Kanara, common near Nilkund and Gairsoppa.

Kanara—Kew Museum (P. of Wales Coll., 1876).

2. DIOSPYROS, Linn.

A large and important genus of about 55 forest trees, some very common, some scarce. They occur chiefly in South India, Ceylon, Burma, Eastern Bengal, four species only extending to Northern India. In Ceylon there are no less than 22 species; in South India 17; in Western India, according to Talbot, 13; 9 in Eastern Bengal and Assam; 22 in Burma. A remarkable point is their nearly complete absence from the Eastern Himalaya. About 8 species occur in the dry forests, the rest in the wet evergreen ones. It will be best to describe them in the order of the subgenera given in the Fl. Br. Ind. iii. 553–572.

The species of *Diospyros* require more investigation by those forest officers whose work lies in the regions where they are common, in order to ascertain which are the black-wooded species and which not. So far as my present information goes, I would classify the ebonies into—

(1) Heartwood wholly black or only slightly streaked: *Ebenum, tomentosa, melanoxylon, assimilis;*

(2) Heartwood regularly streaked black and brown or grey: *Kurzii, quæsita, oocarpa, Thwaitesii, Gardneri, insignis, oppositifolia, undulata;*

(3) Heartwood very small, merely black streaks in the brownish-grey or grey wood: *Embryopteris, foliolosa, sylvatica, ehretioides, microphylla, humilis, ovalifolia, Kaki, Tupru;*

(4) Heartwood none, wood red, white, grey or yellowish: *martabanica, montana, Toposia, foliolosa, Lotus, Chloroxylon, oppositifolia, candolleana, nilagirica, crumenata, pyrrhocarpa.*

The structure of the wood is characteristic and the genus is usually easily recognized. The *wood* is usually black or grey, or greyish-brown, rarely yellowish or red. The *pores* are small or moderate-sized, usually very scanty, single or subdivided or in short (not long as in *Sapotaceæ*) radial lines, the groups distant and arranged more or less obliquely or in echelon. The *medullary rays* are fine, uniform, usually numerous and prominent. The transverse bars are occasionally absent, sometimes they are very faint and irregular, sometimes they join into wavy concentric prominent lines.

The question of the nature and method of deposit of the black colouring water in ebony wood is being studied by Mr. Herbert Wright of Peradeniya, Ceylon, who tells me that it is deposited in the cells and is not caused by a chemical change in the substance of the cell wall. He says that the darker the wood the more durable it is, and this is what was to be expected.

SUBGENUS 1. GUNISANTHUS.

D. pruriens, Dalz.; Bedd. Fl. Sylv. cxliv.; Talbot Bomb. List 122, is a common tree of the forests of the Western Ghâts from N. Kanara southwards, ascending to 3000 ft. in the Wynaad and Anamalais, and having a fruit covered with stinging hairs. *D. pilosula*, Wall. (*Gunisanthus pilosulus*, DC; Kurz For. Fl. ii. 125) is a small evergreen tree of the Khasia Hills, the Pegu Yoma and the tropical forests of the Andamans. *D. martabanica*, Clarke (*Gunisanthus mollis*, Kurz For. Fl. ii. 126) is an evergreen tree of the tropical forests of Martaban with a reddish-brown, heavy, close-grained wood. *D. dasyphylla*, Kurz For. Fl. ii. 138, is also an evergreen tree of the Martaban Hills at 4000 ft.

SUBGENUS 2. EMBRYOPTERIS.

D. Toposia, Ham.; Bedd. Fl. Sylv. cxliv.; Kurz For. Fl. ii. 128; Trimen Fl. Ceyl. iii. 94 (*D. racemosa*, Roxb. Fl. Ind. ii. 536); Vern. *Toposi, gulal*, Beng.; *Thuvarei, karun thuvarei*, Tam.; *Kahakala, kaluwella*, Cingh., is an evergreen tree of the mountains of Eastern Bengal, Chittagong and Ceylon, with an edible fruit and no coloured heartwood. *D. ovalifolia*, Wight; Bedd. Fl. Sylv. cxliii.; Trimen Fl. Ceyl. iii. 91; Vern. *Vedukkanari*, Tam.; *Kunumella, habara*, Cingh., is "a common tree of 'the western forests of South India at 1–3000 ft., the Anamalais, Coorg and the Nalla-'malai Hills of Kurnool" (Bedd.), also of the dry region of Ceylon, with the heartwood streaked with black. *D. nigricans*, Wall., is a tree of the Khasia Hills and Sylhet. *D. variegata*, Kurz For. Fl. ii. 137, is a large deciduous tree of Assam and Burma, with a greyish, heavy, close-grained wood. *D. assimilis*, Bedd. Madras For. Rep. 1866–7, t. 1; Talbot Bomb. List 122; Vern. *Kare*, Kan.; *Abnus, malia*, Mar., is a tree of the evergreen forests of the Konkan, N. Kanara, S. Kanara and Malabar, which, according to Talbot, "yields the ebony used for wood-carving in Kumta and 'Honâvar." It is probably the *Karimara* of Foulkes described as *D. Ebenum* and as growing in mixed forests on the Ghâts of S. Kanara.

1. **D. montana**, Roxb. Fl. Ind. ii. 538; Fl. Br. Ind. iii. 555; Bedd. Fl. Sylv. cxliii.; Brandis For. Fl. 296; Talbot Bomb. List 122; Trimen Fl. Ceyl. iii. 92. *D. cordifolia*, Roxb. Fl. Ind. ii. 538; Bedd. Fl. Sylv. cxliii.; Kurz For. Fl. ii. 130. Vern. *Hirek, keindu, temru, pasendu*, Pb.; *Tendu, dasáundu, lohari, bisténd*, Hind.; *Bistendu, chambér*, Saharanpur; *Makar-tendi*, Banda; *Pasend*, Bhurtpur; *Temru*, Meywar; *Ambia*, Banswara; *Hádru*, Panch Mehals; *Kanchan, kadal, pattewar, patwan*, C.P.; *Kossé kuli*, Uriya; *Muchi tanki, yerragoda, micha-tummurra, pudumaddi, goddigattu*, Tel.; *Timru, timbúrni*, Mar.; *Goindú, kala goindu, balkuniki, jagalagante*, Kan.

A small or moderate-sized, often spinous, deciduous tree. *Bark* thin, grey or greyish-black, rough, when old exfoliating in small scales. *Wood* grey, often tinged with yellow or brown, streaked with narrow patches of darker colour, especially towards the centre, but no regular ebony heartwood, soft to moderately hard. *Pores* small, in short radial groups of 1 to 4, these groups distant and faintly echeloned. *Medullary rays* fine, short, numerous. Transverse lines very faint.

Throughout most of India and Burma (var. *cordifolia* only): from the Ravi eastward along the Himalaya; in Central, Western and Southern India in deciduous forests; dry region of Ceylon.

A very variable tree, nowhere very abundant, and yet very widely spread. The wood is durable: Brandis calls it a "beautiful furniture wood, but the tree rarely grows 'to a size to give timber, and is more often found as a much-branched thorny plant." Graham Anderson says that the natives in Mysore have a superstition that if the wood is used in house-building, there will be quarrels among the inmates, and mentions that it is difficult to cut with the axe. Weight 47 lbs. per cubic foot.

		lbs.
C 192.	Mandla, C.P. (1870)	47
C 1167.	Ahiri Reserve, C.P. (R. Thompson)	44
C 3845.	Surada Forests, Ganjam (Gamble)	50

Nordlinger's Sections, vol. 9.

Var. *cordifolia*. Vern. *Bangáb, moishkanda*, Beng.; *Vackana, kaka ulimera*, Tel.; *Chapraka*, Magh.; *Tawbut, chôk*, Burm.

Bark light greyish-brown, smooth, striated. *Wood* reddish- or yellowish-white, moderately hard. *Pores* small, scanty, often subdivided, in short radial strings. *Medullary rays* very fine, numerous. Transverse lines fine, wavy, faint.

Sub-Himalayan tract, Chittagong and Burma, chiefly in dry and Eng forests; also in S. India, common in the Circars and Carnatic.

Easily distinguished from var. *montana*, and possibly a separate species, as described by Roxburgh, Beddome and others. Kurz, evidently quoting Brandis' List of 1862, No. 74, gives W = 49 lbs.; Skinner gives W = 70 lbs., P = 1017, but this may be a mistake for some other species of Ebony.

		lbs.
O 5091.	Thano, Dehra Dún (Babu U. N. Kanjilal)	45
E 715.	Chittagong (Chester)	45
B 2541.	Burma (Brandis, 1862, No. 74)	49

2. **D. Lotus,** Linn.; Fl. Br. Ind. iii. 555; Brandis For. Fl. 297, t. 36. *Plaqueminier*, Fr. Vern. *Amlúk, malúk*, Pb.

A middle-sized tree. *Bark* dark brown or black, tessellated. *Wood* grey, moderately hard, close-grained. *Pores* small, in short radial groups. *Medullary rays* very fine, close, numerous. No transverse lines.

Punjab Himalaya, in Hazara and Kashmir at 2–6000 ft.; Afghanistan, Baluchistan, extending to Southern Europe.

Clarke, in Fl. Br. Ind., seems to doubt whether this tree is really indigenous in India, and is not rather the result of sowings of the seed after eating the fruit, by the frontier tribes; but there seems no reason otherwise to doubt its being truly wild. Growth slow, 10 rings per inch of radius (Brandis). The fruit is sweet, and is eaten fresh or dried. Mathieu (Fl. For. 237) says the "plaqueminier" fruit is eaten in Southern France when half rotten like the medlar.

H 3183. Dungagalli, Hazara, 5000 ft. (Wild).
Nordlinger's Sections, vol. 2.

3. **D. Kaki,** Linn. f.; Fl. Br. Ind. iii. 555; Roxb. Fl. Ind. ii. 527; Talbot Bomb. List 122. Vern. *Kég*, Burm.

A small tree. *Wood* greyish-white, moderately hard. *Pores* small to moderate-sized, often subdivided into 2 to 4, in short radial lines, scanty, distant, those of spring wood larger, and so marking the *annual rings*. *Medullary rays* fine, numerous, regular. Transverse bars fine, faint, irregular.

Khasia Hills in Assam—probably extending to Upper Burma; China and Japan.

This is a fruit tree: Talbot says it is cultivated near Bombay, and Lieut. Pottinger had the fruit brought to him in the Kachin Hills, though he did not see the tree. Roxburgh says it was introduced from China by Col. Kyd, but that in Calcutta it produces fruit badly and grows slowly. Ferrars, in Ind. For. i. 113, mentions it under the name of *Teh* as covering large areas almost exclusively in the Karennee Hills. I think it, therefore, highly probable that Col. Bingham's specimen *Talok tè* belongs to this species.

		lbs.
B 5077.	Upper Burma (Bingham)	40

Nordlinger's Sections, vol. 5.

4. **D. Embryopteris,** Pers.; Fl. Br. Ind. iii. 556; Bedd. Fl. Sylv. t. 69; Brandis For. Fl. 298; Kurz For. Fl. ii. 128; Talbot Bomb. List 122; Trimen Fl. Ceyl. iii. 93. *D. glutinosa*, Roxb. Fl. Ind. ii. 533. Vern. *Gáb, makur-kendi, kala tendu*, Beng., Hind.; *Kúsi*, Banda; *Kendu*, Ass.; *Gusvakendhu*, Uriya; *Gara tiril*, Kól, Sonthal; *Titia*, Khond; *Nitituníka*, Palkonda; *Muttia tumiki*, Reddi; *Timburi*, Mar.; *Panichi*, Mal.; *Tumbika, pani-chika, panichchai*, Tam.; *Tumil, tumika*, Tel.; *Holle-tupra*, Coorg; *Kusharta*, Kan.; *Timbiri*, Cingh.

A much-branched evergreen tree. *Bark* smooth, dark grey, almost black, with a greenish tinge. *Wood* grey, with darker streaks and a darker irregular patch in the centre (heartwood ?), moderately hard, close-grained. *Pores* small, scanty, subdivided, or in short radial lines. *Medullary rays* very fine, very numerous. Transverse bars very faint or wanting.

Throughout the greater part of India, in wet places and along streams: in the sub-Himalayan tract from the Jumna to Sikkim; in Bengal; throughout Central, Western and South India, especially common in the Circars; Martaban and Tenasserim in Burma; low country of Ceylon. It is apparently absent from the Eastern sub-Himalayan tract, Assam, Eastern Bengal and Pegu, also from the northern part of Bombay, Sind and the Punjab. It is often cultivated for ornament or for its useful fruit.

A characteristic tree of swampy places in many parts of India, so much branched as often to resemble a large shrub, but often again reaching a considerable girth. When covered with its large red velvety fruit, scattered among the dark green shining leaves, it is a striking plant. It is frequently cultivated, and the large quantities of the fruit used on the rivers and creeks of Lower Bengal are probably for the most part the produce of trees planted in villages, or reserved by villagers on the banks of water-courses. Buchanan-Hamilton, quoted in Watt's Dict., says that a good tree will give 4000 fruits, worth at that time Rs.2, and now probably much more.

The fruit contains a viscid pulp, which is used as gum in bookbinding, and in place of tar for paying the seams of fishing-boats. Its use for "gabing" boats is general throughout the rivers of Lower Bengal and Assam. An infusion is used to render fishing-nets durable. It is full of tannin, and is used in dyeing and tanning and in medicine as an astringent. The oil extracted from the seeds is used in native medicine.

The wood is little used; Beddome says it is employed in building.

	lbs.
O 3161. Dehra Dún (Col. Bailey)	52
C 3474. Saranda Forests, Chota Nagpore (Gamble)	40
Ceylon Collection, No. 137 (new)	45

5. D. foliolosa, Wall.; Fl. Br. Ind. iii. 556. *D. calycina*, Bedd. Fl. Sylv. t. 68. Vern. *Vellay thuvarei*, Tam.

A moderate-sized tree. *Bark* dark brown, smooth. *Wood* yellowish-white, clouded with grey and occasionally black, hard; concentric lines not visible. *Pores* very small, scanty, in radial arrangement. *Medullary rays* very fine, very close, numerous.

Forests of Madura and Tinnevelly in S. India, up to 3000 ft.

According to Beddome, the wood is much in use in Tinnevelly.

"East Indies"—Kew Museum.

6. D. Ebenum, Koenig; Fl. Br. Ind. iii. 558; Roxb. Fl. Ind. ii. 529; Bedd. Fl. Sylv. t. 65; Brandis For. Fl. 296; Trimen Fl. Ceyl. iii. 94. *D. Ebenaster*, Willd.; Roxb. Fl. Ind. iii. 529. Ebony. Vern. *Ebans, abnús, tendu*, Hind.; *Kendhu*, Uriya; *Acha, tumbi, shengútan, kaka-tati, tai, karunthali, karunkali*, Tam.; *Tuki, nalluti*, Tel.; *Karemara*, Kan.; *Tai, tendu, abnús*, Mar.; *Mallali*, Manjarabad; *Karu, mush-timbi*, Mal.; *Kalúwara*, Cingh.

A large tree. *Bark* dark grey, finely cracked longitudinally. *Wood* very hard, close- and even-grained: sapwood grey, often streaked with black; heartwood jet black. *Pores* small, scanty, in short radial lines. *Medullary rays* very fine, numerous, equidistant. Transverse bars very fine, indistinct.

Forests of the Deccan and Carnatic, chiefly in dry evergreen forests in the Ceded Districts, especially Kurnool and Cuddapah, scarcer southwards; dry regions of Ceylon, chiefly in the Northern Provinces, but extending to the south-east round the coast (see map at p. 275, Ind. For. xxv., by A. F. Broun).

This, the chief ebony-yielding tree, and the only one giving a black wood without other streaks or markings, is very little cut and exported in India, the trees not being very common, and being found only here and there and of small size. But in Ceylon

it is one of the chief woods, and its importance may be gauged by the fact mentioned by Broun ("Ceylon Ebony," in Ind. For. xxv. 275, which may be consulted for fuller information than is here given) that the average sales of the last ten years by the Ceylon Forest Department have been 300 tons yearly. This is since Conservancy has been started, with an attempt to work out only the annual yield, for before 1889 the yearly sales were over 1000 tons, and in 1881 as much as 2600 tons, a rate which would soon have exhausted the resources of the forests. The prices obtained range usually from 150 to 210 Rs. per ton, the average being about 180 to 185 Rs., and the chief markets are England, Germany and China. In Europe the wood "is used 'for turnery, cabinet-work, the keys of pianos, rulers, the backs of brushes, etc.; 'in China for chopsticks, pipes, carved stands for vases and images, etc." (Broun). Broun says that a tree reaches a girth of 18 in. at 25 years, 36 in. at 75 years, 54 in. at 135 years, and 6 ft. at 200 years; and mentions that the largest log he had seen had a girth of 7 ft.

Ebony prefers a rocky, well-drained soil, and is found chiefly in company with other species of Diospyros, also Satinwood, *Mimusops hexandra*, *Nephelium Longana*. It is never found to be gregarious. Seedlings are shade-enduring, but require to have the cover removed when they are established. Good seed years are not regular, but occur perhaps once in five.

Beddome gives W = 81 lbs.; A. Mendis 71 lbs.; Broun 74 lbs.; Bourdillon 69 lbs., the specimens here enumerated give an average of 70½ lbs.; probably 74 lbs. is a fair average for only heartwood. Mendis gives P = 720, Bourdillon 1160.

		lbs.
D 4173.	Dornál Pass, Kurnool (Gamble), part sapwood	67
D 4023.	Cuddapah Forests (Higgens)	79
D 3985.	Ballipalle Forests, Cuddapah (Gamble)	75
W 731, 750.	South Kanara (Cherry)	61 and 70
Ceylon Collection, No. 13 (old), No. 61 (new) (Mendis)		71

Subgenus 3. BRACHYANTHOS.

7. **D. sylvatica**, Roxb. Fl. Ind. ii. 537; Fl. Br. Ind. iii. 559; Bedd. Fl. Sylv. cxliii.; Talbot Bomb. List 122; Trimen Fl. Ceyl. iii. 98. Vern. *Kanchia*, *kaluchia*, Uriya; *Gata*, Polkonda; *Nalla ghanta*, Reddi; *Tella gada*, Tel.; *Kaka suroli*, Kan.; *Sudu-kadumbériya*, Cingh.

A large or moderate-sized tree. *Bark* thin, blackish-grey with white patches, smooth except for a few horizontal lenticels. *Wood* grey, with black streaks and irregular black patches in the centre, hardly true heartwood, moderately hard. *Pores* scanty, grouped in short radial lines, the groups distant and somewhat echeloned. *Medullary rays* fine, numerous, regular, well marked. Transverse bars clear, fine, regular, wavy, in concentric lines.

Forests of South India: common in Orissa and the N. Circars; evergreen forests of the Konkan and N. Kanara and southwards up to 4000 ft.; moist low country of Ceylon.

A prominent tree in the forests of the Circars, reaching a considerable size; growth slow, 11 rings per inch of radius.

		lbs.
C 3821.	Rogada Forest, Ganjam (Gamble)	50

8. **D. ehretioides**, Wall.; Fl. Br. Ind. iii. 559; Kurz For. Fl. ii. 129.

A large deciduous tree. *Bark* dark grey, corky and fissured. *Wood* dark grey, with darker streaks, moderately hard, even-grained. *Pores* moderate-sized, almost large, very scanty, often subdivided, making prominent lines on a vertical section. *Medullary rays* fine, numerous, regular. Transverse bars very fine, faint, irregular.

Deciduous forests, all over Burma, up to 3000 ft.

A common Burmese tree. The wood is used for house-posts. Kurz gives W = 41 lbs. (Brandis' List of 1862, No. 73), but Brandis' specimen weighs 52 lbs.

		lbs.
B 1422.	Tharrawaddy, Burma (Ribbentrop)	54
B 2542.	Burma (Brandis, 1862)	52

9. D. Kurzii, Hiern; Fl. Br. Ind. iii. 559; Kurz For. Fl. ii. 131. Andaman Marble Wood or Zebra Wood. Vern. *Teakah, thitkya,* Burm.; *Pecha-da,* And.

An evergreen tree. *Bark* very thin, grey, smooth. *Wood* hard: sapwood grey; heartwood streaked black and grey in more or less alternate layers, or rarely quite black. *Pores* small and very small, scanty. *Medullary rays* very fine, numerous, uniform and equidistant. Transverse bars very fine, numerous, irregular, faint.

Tropical and moister upper mixed forests of the Andamans; Nicobars, Batti Malv, Little Coco, rare on Great Coco Island (Prain).

One of the most important trees of the Andamans, with a wood that should be of great value in the European market, if it can be supplied in sufficient quantity and become known. Heinig says it squares up to 20 ft. long, siding up to 9 in.; Ferrars gave 20 ft. with a siding of 12 in. Heinig and Ferrers both say it is difficult to season and is liable to shrink and warp; this clearly points to the advisability of studying the question of whether the seasoning could not be improved, either by previous girdling, or by keeping in water, or by export in log or otherwise. The wood is useful for cabinet-work, sticks, frames and carvings. Its sylviculture apparently requires study.

		lbs.
B 521.	Andaman Islands (Genl. Barlwell)	62
B 2203.	„ „ (Col. Ford, 1866)	57
B 2498.	„ „ (Home, 1874, No. 15)	80

10. D. microphylla, Bedd. Fl. Sylv. cxlv.; Fl. Br. Ind. iii. 559; Talbot Bomb. List 122. Vern. *Chinna thuvarei,* Tam.; *Elicheviccha,* Mal.; *Chorakuli,* Trav. Hills.

A large tree. *Bark* white. *Wood* dark grey or reddish-grey, hard. *Pores* large, scanty, often subdivided, obliquely arranged. *Medullary rays* very fine, regular, numerous. Transverse bars narrow, very close and frequent, concentric.

Evergreen forests of the Western Ghâts from N. Kanara to Travancore, extending to the Wynaad and Anamalais and ascending to 3000 ft.

A tree with very small leaves, like those of the box. Bourdillon gives W = 49 lbs., P = 643.

		lbs.
W 4617.	Travancore (Bourdillon)	49
	S. Kanara—Kew Museum.	

11. D. Chloroxylon, Roxb. Fl. Ind. ii. 538; Bedd. Fl. Sylv. cxliii.; Brandis For. Fl. 297; Talbot Bomb. List 122. Vern. *Ninai, nensi,* Mar.; *Illinda, aulanche, nella ulimira, vullinda, vullingi,* Tel.; *Kosai,* Uriya; *Tori,* Palkonda; *Andúli,* Gondi.

A large shrub or small tree. *Bark* dark brown, nearly black, cleft longitudinally and peeling off in small rectangular corky scales. *Wood* yellowish-grey, moderately hard. *Pores* small to moderate-sized, single or subdivided or in radial strings of 1 to 4 or more, scanty. *Medullary rays* fine, numerous. Transverse lines faint, irregular.

Central and South India: Orissa and the Circars; Deccan and Mahratta country from Guzerat southwards; Carnatic.

A common and conspicuous plant in the dry evergreen forests of Cuddapah, Kurnool, North Arcot and Chingleput, extending northwards on the east to Orissa, on the west to Guzerat. It prefers laterite and sandstone hills, and is a useful plant as a fuel-yielder.

		lbs.
D 4891.	Godavari Forests (E. D. M. Hooper)	46
	Nordlinger's Sections, vol. 7 (*D. tomentosa,* Poir.).	

12. D. humilis, Bourdillon in Journ. Bomb. Nat. Hist. Soc. xii. 352, t. 4. Vern. *Vellei thuvarei,* Tam.

A small tree. *Bark* $\frac{1}{4}$ in. thick, green mottled with black. *Wood* hard, dull greyish-brown, tinged with purple, with small patches of black near the centre, but no other heartwood. *Pores* small, very

scanty, subdivided or in short radial lines of 2 or 3, which are very distant and arranged obliquely or in echelon. *Medullary rays* very fine, regular, numerous. Transverse bars conspicuous, joined with regular, wavy, concentric, but very narrow belts.

Evergreen forests of Travancore at about 2000 ft.

This is said by Bourdillon to reach only a height of 30 ft. and diameter of 10 in. He gives W = 54 lbs., P = 579. It appears to belong to this subgenus.

	lbs.
W 4687. Travancore (Bourdillon)	57

W 4684 is another specimen sent by Mr. Bourdillon, which he says belongs to a new species shortly to be described. *Wood* greyish-white with irregular rings of black shaded into brown. *Pores* small, subdivided or in short radial lines of 2 or 3, the groups thus made being distant. *Medullary rays* fine, regular. Transverse line in concentric, wavy, narrow belts, more distant than in *D. humilis.* Weight 49 lbs. per cubic foot.

SUBGENUS 4. EBENUS.

13. **D. oocarpa,** Thw.; Fl. Br. Ind. iii. 560; Talbot Bomb. List 122; Trimen Fl. Ceyl. iii. 97. Vern. *Vellei-karunkali,* Tam.; *Kalu-kadumbériya,* Cingh.

A moderate-sized tree. *Bark* yellowish. *Wood* greyish-brown with irregular purplish-black heartwood, here and there with paler streaks, moderately hard (the specimen is soft, but the wood has clearly decayed somewhat). *Pores* moderate-sized to large, very scanty, sometimes subdivided. *Medullary rays* very fine, numerous, not clear. Transverse bars very faint.

Konkan and N. Kanara in evergreen forests; low country of Ceylon.

The wood is like Calamander and can probably be used like it. In the new collection the name of this has been changed to *D. Gardneri,* but the structure is not that of *D. Gardneri,* and the elder Mendis probably knew his wood better than his successor, so I retain his determination.

	lbs.
No. 40 (old), 56 (new) Ceylon Collection (Mendis)	45

14. **D. quaesita,** Thw.; Fl. Br. Ind. iii. 560; Bedd. Fl. Sylv. cxlv.; Trimen Fl. Ceyl. iii. 97. Calamander Wood. Vern. *Kaluméditiya,* Cingh.

A large tree. *Bark* thin, blackish-grey, smooth or with slight longitudinal fissures. *Wood* hard, greyish-brown, variegated with broad or narrow belts of black. *Pores* moderate-sized, scanty, subdivided or in short radial strings, these being distant and roughly in echelon. *Medullary rays* fine, numerous, equidistant. Transverse bars conspicuous, combined into regular narrow, wavy, concentric lines.

Forests of the moist low country of Ceylon, below 1000 ft., now scarce.

This is the chief of the trees producing the variegated ebony known as Calamander wood, which is the most valuable ornamental wood of Ceylon, now unfortunately scarce, having been much sought for and the trees cut. The wood is used for ornamental cabinet-work. Skinner, No. 61, gives W = 60 lbs., P = 751; A. Mendis gives W = 57 lbs.

	lbs.
2923. Ceylon	53
No. 12 (old), No. 62 (new) Ceylon Collection (Mendis)	57

SUBGENUS 5. NOLTIA.

D. attenuata, Thw. and *D. acuta,* Thw. are endemic rare Ceylon trees of the moist low country. Mr. Herbert Wright says they are "very small trees, often clustered, 'the stems, though only 1 to 3 in. in diameter, produce abundance of flower and fruit. The 'timber is of no use whatever, on account of the smallness in size." *D. lanceæfolia,* Roxb. Fl. Ind. ii. 537; Kurz For. Fl. ii. 136; Vern. *Gulal,* Beng.; *Soilo,* Khasia, is a large tree of the Khasia Hills, Sylhet and Cachar, also of Upper Tenasserim, said by

Roxburgh to have a hard durable timber, used in house-building, and to have an edible fruit. *D. stricta*, Roxb. Fl. Ind. ii. 539; Kurz For. Fl. ii. 137, is also a large tree of Sylhet, Tippera and Chittagong. *D. sapotoides*, Kurz For. Fl. 136 and *D. flavicans*, Hiern; Kurz For. Fl. ii. 135, are Burmese trees, the former of the forests of the Pegu Yoma, the latter of Tenasserim.

15. D. Gardneri, Thw.; Fl. Br. Ind. iii. 561; Bedd. Fl. Sylv. cxlvi.; Trimen Fl. Ceyl. iii. 96. Vern. *Kadumbériya, kallu*, Cingh.

A moderate-sized tree. *Bark* thick, blackish. *Wood* greyish-brown with irregular black clouded patches. *Pores* small, scanty, in short radial lines, the patches distant. *Medullary rays* fine, numerous, equidistant. Transverse bars very faint.

Moist region of Ceylon, up to 2000 ft.

		lbs.
4904.	Ceylon	60

SUBGENUS 6. MELONIA.

D. burmanica, Kurz For. Fl. iii. 565; Vern. *Tè*, Burm., is a common, often stunted, deciduous tree of the dry forests, especially Engdeing, in Upper Burma and Prome, less common in Pegu and Martaban. *D. Packmanni*, Clarke is a tree of Tavoy *D. insignis*, Thw.; Bedd. Fl. Sylv. cxlv.; Trimen Fl. Ceyl. iii. 100; Vern. *Gona, poruwamara, walmédiriya*, Cingh., is a large tree of the Anamalai Hills in South India at 2–3000 ft., and the moist low country of Ceylon. Trimen says that the heartwood is very small, black, with paler streaks. *D. affinis*, Thw.; Bedd. Fl. Sylv. cxlv.; Trimen Fl. Ceyl. iii. 102, is a moderate-sized tree of the Tinnevelly Hills, and, but scarce, the hills of Ceylon. *D. hirsuta*, Linn. f., *D. Thwaitesii*, Bedd. and *D. Moonii*, Thw.; Trimen Fl. Ceyl. iii. 99–101, are all scarce endemic Ceylon trees. Mr. Herbert Wright says that "the former reaches a height of 50 ft. and girth of 5 ft., and has 'a reddish wood with a small black central patch."

No. 50 (new) Ceylon Collection; Vern. *Homediriya*, Cingh., is called *D. Candolleana*. According to Trimen this is *D. Thwaitesii*, Bedd., and if this identification is also correct for the wood specimen, *D. Thwaitesii* has a reddish-brown, Calamander-like *wood*, with large, irregular, black heartwood. *Pores* moderate-sized, very scanty. *Medullary rays* fine, rather distant. Transverse bars fairly conspicuous, joined into concentric wavy lines. Weight 55 lbs. per cubic foot.

16. D. Tupru, Buch.-Ham.; Fl. Br. Ind. iii. 563; Talbot Bomb. List 123. Vern. *Tuparada*, Kan.; *Tartar*, Mar.

A small tree. *Wood* reddish-yellow, hard, with irregular faint concentric wavy lines and occasional black patches. *Pores* moderate-sized, scanty, subdivided or in radial strings. *Medullary rays* fine, numerous, short.

Western Coast and Western Gháts from the Konkan to Mysore.
Mysore—Kew Museum.

17. D. tomentosa, Roxb. Fl. Ind. ii. 532; Fl. Br. Ind. iii. 564. *D. Melanoxylon*, Roxb.; Brandis For. Fl. 294 (in part). Vern. *Tendu, kendu, temru, abnús*, Hind.; *Kend, kyon*, Beng.; *Kendhu*, Uriya; *Tumri, tummer, tumki*, Gondi; *Tendú*, Baigas; *Tiril*, Kól; *Tumiki*, Koya; *Tumma*, Reddi; *Timru, tibru*, Merwara.

A large (Circars) or small (N. India) tree. *Bark* ½ in. thick, greyish-black, inner bark black, charcoal-like, the outside cleft into small regular scales. *Wood* very hard, dark reddish-brown, with an irregular black heartwood, occasionally streaked with purple or brown. *Pores* scanty, moderate-sized to large, often oval and subdivided, sometimes in short radial strings of 2 or 3, the patches distant. *Medullary rays* very fine, very numerous. Transverse bars very faint.

Northern India; in the sub-Himalayan tract and Siwaliks from the Ravi to Nepal, most common in Western Saharanpur and Bijnor; Bengal (Roxburgh says Northern

Bengal, but I never saw it in the Terai or Dúars, so it probably does not extend beyond Purneah and Rungpore); Rajputana, Central Provinces, Berar, Chota Nagpore, Orissa and the N. Circars down to the Godavari.

Brandis unites this with *D. Melanoxylon*, and, indeed, it is very difficult to distinguish them either in the field or in the Herbarium. Taking the leaf-character of "nerves impressed" (*D. tomentosa*) and "nerves raised" (*D. Melanoxylon*), I have separated the specimens I have seen or collected, but I am still in doubt about the Orissa and Circar trees, for though by these characters they seem to be *D. tomentosa*, it seems probable that it was in that region that Roxburgh found his *D. Melanoxylon*. However that may be, this is the tree that gives the Ebony of Northern India, which, in the North-West Provinces, especially about Najibabad and Nagina in Bijnor, is made into carved walking-sticks, combs, picture-frames, and such-like articles. I do not think it is ever exported, but the trees in the N. Circars give a good amount of heartwood, and could supply a small trade. Brandis says the wood is used in building, for shoulder-poles and carriage-shafts. The wood when burnt gives out showers of sparks, as probably do all the species of the genus, and it is a common amusement to put pieces in a camp fire in order to see the column of sparks ascend. The following experiments have been made with the wood: Cunningham, in 1854, at Gwalior, with bars 2′ × 1″ × 1″, found W = 77 lbs., P = 862, while Kyd found W = 49½ lbs., P = 547; R. Thompson, W = 49½ lbs.; Wallich 61 lbs., and the specimens herein enumerated give 60 lbs. We can probably take 60 lbs. as an average for part sap, part heartwood; and 68 lbs. for only heartwood. An analysis of the ashes of 100 lbs. steam-dry wood gave 2·34 lbs. of ash, of which as much as 1·79 lbs. consisted of calcium carbonate, with 0·29 lb. magnesium carbonate and little else.

This Ebony delights in dry, stony hills, but is also found on almost any forest soil. It reproduces in abundance, from seed, from root-suckers, and by coppice shoots. As R. Thompson, quoted by Brandis, remarks, it is almost the last tree to disappear on forest lands cleared for cultivation, and it is usually one of the first to come up on lands left fallow. If it were considered advisable it would be easy to protect, assist, and extend its growth, so as almost to make it into gregarious forest capable of regular working. The fruit is eaten.

			lbs.
P	170.	Hoshiarpur, Punjab (Sir D. McLeod, 1866, see J. L. Stewart in "Punjab Plants," 137)	69
P	469.	Ajmere	59
O	1492.	Kheri, Oudh (Wood)	55
O	2981.	Bahraich, Oudh (Wood)	48
C	828.	Bairagarh Reserve, Berar (Drysdale)	53
C	1113.	Ahiri Reserve, C. P. (R. Thompson)	—
C	2754.	Mobarli Reserve, C. P. (Brandis)	—
C	3683.	Palamow Forests (Gamble)	63
C	3493.	Kolhán Forests, Singbhúm (Gamble)	—
C	1237, 1301.	Gumsúr Forests, Ganjam (Dampier)	65 and 77
C	3854.	Bondagocha Forest, Ganjam (Gamble)	52
C	4102.	Godavari Forests (Gamble)	—

18. D. Melanoxylon; Roxb. Fl. Ind. iii. 530; Fl. Br. Ind. iii. 564; Brandis For. Fl. 294 (in part); Talbot Bomb. List 123; Trimen Fl. Ceyl. iii. 99. *D. Wightiana*, Bedd. Fl. Sylv. t. 67. *D. exsculpta*, Bedd. Fl. Sylv. t. 66 (var. *Beddomei*, Clarke in Fl. Br. Ind.). Vern. *Tendu, temru, timburni*, Mar.; *Tumi, tumki, tumida, timmurri, damádi, tuki*, Tel.; *Balai*, Kan.

A large or small deciduous tree. *Bark* greyish-black, cleft into small rectangular plates, showing the black inner bark in the clefts. The bark shows alternate layers of brown and black, so that as it wears the surface shows partly of either colour. *Wood* hard, reddish-brown, with an irregular black heartwood. *Pores* small, very scanty, single or in radial lines of 2 or 3 together, the lines often in echelon. *Medullary rays* fine, numerous. Transverse bars very fine, very faint, wavy, roughly joining into concentric lines.

South India: dry forests of the Mahratta country, Deccan and Carnatic, common; rare in the dry region of Ceylon: "near Bibile on 'patana' ground" (H. Wright).

The question of this tree and its separation from *D. tomentosa* has been discussed under that species, and as regards uses the same remarks will apply. Large trees are uncommon, and the amount of ebony available is small, so that the demand for it is not great. The tree affects chiefly dry rocky hills. As regards weight, Puckle's experiments with Mysore wood gave W = 75 lbs.; Skinner, No. 62, gave W = 80 lbs., P = 1180; O'Connell 59 lbs.; the specimens here enumerated give W = 75 lbs., so that the wood is decidedly heavier than that of *D. tomentosa*. The fruit is edible.

The young plants are frequently damaged by the scale-insect, *Psylla obsoleta*, Buckton, which attacks the leaves ("Ind. Mus. Notes," v. 35).

	lbs.
D 4872. N. Arcot (W. Carroll)	50 (young)
D 2008, 2045. Mysore	73 and 70
No. 26, Salem Collection	82

Nordlinger's Sections, vol. 9 (Tab. IX. 6).

19. D. oppositifolia, Thw.; Fl. Br. Ind. iii. 565; Bedd. Fl. Sylv. cxlvi.; Trimen Fl. Ceyl. iii. 100. Vern. *Kalumédiriya*, Cingh.

A moderate-sized tree. *Wood* greyish-white, soft, with faint but scattered concentric lines. *Pores* moderate-sized, scanty, often subdivided. *Medullary rays* fine, numerous, regular.

Moist low country of Ceylon.

A very rare tree. Thwaites, quoted by Trimen, says that the wood resembles that of Calamander (*D. quæsita*), but the specimen does not bear this out completely. H. Wright says that it sometimes reaches 5 ft. girth at breast height, and has a plain white wood, with always a hollow centre.

Ceylon—Kew Museum (P. of Wales Coll., 1876).

20. D. Candolleana, Wight; Fl. Br. Ind. iii. 566; Bedd. Fl. Sylv. cxliv.; Talbot Bomb. List 123. *D. canarica*, Bedd. Fl. Sylv. cxlv. Vern. *Karamara*, Kan.

A large tree. *Wood* red, hard. *Pores* small to moderate-sized, scanty, often subdivided. *Medullary rays* fine, very numerous. Transverse bars fairly prominent, combining into wavy concentric lines.

Evergreen forests of the Western Coast, Konkan and N. Kanara, common about Carwar; also, probably, hills of the Eastern Ghâts, such as Mahendragiri and Rumpa, up to 4000 ft.

	lbs.
W 4680. Travancore (Bourdillon)	54

21. D. nilagirica, Bedd. Fl. Sylv. cxliv.; Fl. Br. Ind. iii. 566.

A moderate-sized tree. *Wood* yellowish-brown, moderately hard. *Pores* scanty, moderate-sized, often subdivided into 3 or 4, and then in radial or oblique strings. *Medullary rays* very fine, very numerous. Transverse bars prominent, combined into narrow concentric wavy lines.

Hills of S. India, Nilgiris to Travancore, common at Sispara, at 3–4000 ft.

Bourdillon gives W = 44 lbs., P = 605. No black heartwood.

	lbs.
W 4600. Travancore (Bourdillon)	46

22. D. crumenata, Thw.; Fl. Br. Ind. iii. 567; Bedd. Fl. Sylv. cxlv.; Talbot in Journ. Bomb. Nat. Hist. Soc. xi. 692, t. 14; Trimen Fl. Ceyl. iii. 102. Vern. *Kan tumri*, Kan.

A very large tree. *Bark* thin, scaly, cinereous. *Wood* reddish-brown, hard, close-grained. *Pores* very scanty, moderate-sized, single or subdivided, or in strings of 1 to 4, the patches obliquely arranged. *Medullary rays* very fine, very numerous.

Evergreen forests of North Kanara, between the Gairsoppah and Dodmune Ghâts; moist region of Ceylon at 2–4000 ft.

Talbot says this tree, only recently discovered by him to be found in India as well

as in Ceylon, grows to 100 and 150 ft. high, with 4 to 5 ft. diameter at base. He gives W = 54 lbs.

		lbs.
W 4827.	Dodmune Ghát, N. Kanara (Talbot)	48

SUBGENUS 7. ARGOPHYLLUM.

D. oleifolia, Wall.; Kurz For. Fl. ii. 132; Vern. *Chôk*, Burm., is an evergreen tree common in the tropical forests of Martaban and Tenasserim, with a white or yellowish-white close-grained wood. *D. discolor*, Willd. is a fine tree with large red velvety fruit, often cultivated in India.

23. D. undulata, Wall.; Fl. Br. Ind. iii. 568; Kurz For. Fl. ii. 135. Vern. *Hingadu*, Burm.

A large tree. *Wood* purplish-grey, with a small irregular black heartwood. *Pores* small, in short radial lines, scanty. *Medullary rays* very fine, close, undulating. Transverse bars numerous, wavy, concentric.

Tropical forests of Martaban, Tenasserim and the Andamans.

		lbs.
B 1997.	Andaman Islands (Kurz, 1866)	49

SUBGENUS 8. HORSFIELDIA.

D. densiflora, Wall.; Kurz For. Fl. ii. 134, is a rather scarce tree of Arracan, Martaban and Tenasserim; and *D. Brandisiana*, Kurz For. Fl. ii. 138 is an evergreen tree of Tenasserim and Upper Burma. *D. paniculata*, Dalz.; Bedd. Fl. Sylv. cxliv.; Talbot Bomb. List 123, is a tree of the Western Ghâts, in evergreen forests in the Konkan, N. Kanara, the Wynaad, Anamalais and Travancore, up to 3000 ft. *D. ramiflora*, Roxb. Fl. Ind. ii. 535; Vern. *Uri-gáb*, *gulal*, Beng., is a large tree of the Khasia Hills and the hills of Tippera in Eastern Bengal, with, according to Roxburgh, a strong hard wood and a large globular apple-like fruit.

No. W 4613 from Travancore (Bourdillon), 40 lbs. per cubic foot, is said to be *D. paniculata*, Dalz. The *wood* is soft, white, with iron-grey heartwood, streaked with darker lines. *Pores* very scanty, moderate-sized or large, faintly obliquely echeloned. *Medullary rays* very fine, very numerous, wavy.

Besides the species described in the eight subgenera above mentioned, there are several which are imperfectly known, and it is unnecessary to refer to these, except the following:—

24. D. pyrrhocarpa, Miq.; Fl. Br. Ind. iii. 571; Kurz For. Fl. ii. 136. Vern. *Tè*, Burm.

An evergreen tree. *Wood* reddish-brown, moderately hard to hard. *Pores* small, scanty, in short radial lines. *Medullary rays* very fine, close. Transverse lines fine.

Andaman Islands.

Col. Ford says that the fruit is eaten by Burmese, and is used as a red dye for linen; and that Chinese umbrellas are dyed with the juice, which also has the property of rendering them waterproof.

		lbs.
B 1991.	Andaman Islands (Kurz, 1866)	50
B 2244.	" " (Col. Ford, 1866)	54

25. D. sp. from the Andamans (B 2232, 61 lbs.). Vern. *Moong*, Burm., has very small scanty *pores*, often in short radial lines between the closely-packed, very fine, uniform, *medullary rays*. No concentric lines; white streaks parallel to the medullary rays.

Major Ford says that "the wood is hard, compact and close-grained, dark-purplish 'grey with narrow streaks of jet black ebony. The bark and fruit of this tree produce 'a beautiful black dye. The Burmese use the wood for flutes and other wind instru- 'ments, for earrings, carved images, tool-handles, picture-frames, etc. The black heart- 'wood of large trees has a diameter of about 4 to 5 inches." It may possibly be *D. pilosula*, Wall.

ORDER LXIX.—STYRACEÆ.

Two Indian genera, Symplocos and Styrax, trees or shrubs usually of small size, and of little importance.

Wood white, soft. *Pores* small. *Medullary rays* numerous, often of two classes. *Styrax* has transverse concentric lines.

1. SYMPLOCOS, Linn.

A large genus of 54 Indian and Ceylon species, mostly small trees of the evergreen hill forests, like those of the Darjeeling Hills and the "sholas" of the South Indian and Ceylon hill ranges. No less than 17 species are endemic in the mountains of Ceylon, none of them very common and none of any particular importance. Another 17 species are found in the hills of South India, some of them rather important and conspicuous trees in the sholas. Ten species are found in the Darjeeling Hills, and about eight in those of Assam, while 8 to 10 occur in Burma, some quite scarce. About three species extend as far north as Garhwal and one only to the Punjab Himalaya and Kashmir.

S. phyllocalyx, Clarke; Fl. Br. Ind. iii. 578; Gamble Darj. List 54, is a small tree of the forests of the higher Darjeeling Hills at 8–10,000 ft. *S. Sumuntia*, Ham.; Fl. Br. Ind. iii. 578; Gamble Darj. List 54, is a small tree of the Darjeeling Hills at about 7000 ft., extending eastwards to the Khasia Hills in Assam. *S. grandiflora*, Wall.; Fl. Br. Ind. iii. 578; Vern. *Bumroti*, Ass.; *Moat soom*, Phekial, is a tree of Assam and the Khasia Hills whose leaves are said by Mann to be used to feed the "*Muga*" silkworm (*Antheræa Assama*, Westw.) and for a dye. Watt thinks, however, that it is the "*Eri*" and not the "*Muga*" worm that feeds on this plant. *S. leucantha*, Kurz For. Fl. ii. 148; Fl. Br. Ind. iii. 579; Vern. *Thalè*, Burm., is an evergreen tree of the swamp forests of the Irrawaddy delta; and *S. sulcata*, Kurz For. Fl. ii. 145, is an evergreen small tree of the drier hill forests of Martaban and Tenasserim at 3–6000 ft. *S. Beddomei*, Clarke; Fl. Br. Ind. iii. 582; Talbot Bomb. List 124; Vern. *Lodhra, hura*, Mar., is an evergreen tree common on the borders of evergreen forests and in moist places along streams in the Konkan, N. Kanara and Coorg. *S. oligandra*, Bedd.; Fl. Sylv. cl.; Fl. Br. Ind. iii. 574, is a tree of the Ghâts of Travancore and Tinnevelly. *S. anamallayana*, Bedd. and *S. rosea*, Bedd. are small trees of the Anamalai Hills. *S. microphylla*, Wight is a large shrub or small tree of the sholas in the Kundahs region of the Nilgiris; *S. pulchra*, Wight is another Kundahs shrub, found near Sispara and remarkable for its branches covered with tawny hairs; *S. Gardneriana*, Wight; Bedd. Fl. Sylv. t. 237, is another tree of the Nilgiri sholas, extending southwards to the mountains of Travancore; while *S. obtusa*, Wall.; Fl. Br. Ind. iii. 583; Bedd. Fl. Sylv. cxlix.; Trimen Fl. Ceyl. iii. 104, is a common tree in the sholas of the Nilgiris about Ootacamund, the Anamalai Hills and the hills of Ceylon. Trimen says of this that stumps of it left in the ground are very harmful to tea-plants planted in their vicinity.

Wood white, close-grained, soft. *Pores* small, numerous, usually evenly distributed. *Medullary rays* fine and moderately broad, the latter short.

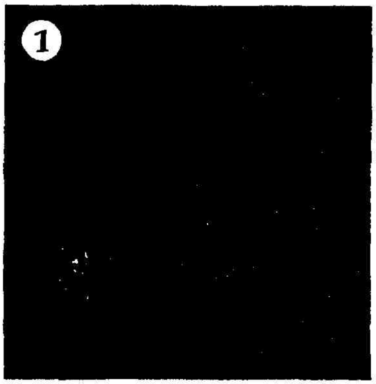
1. **S. cratægoides**, Buch.-Ham.; Fl. Br. Ind. iii. 573; Brandis For. Fl. 298; Kurz For. Fl. ii. 147. Vern. *Lú, lándar, loj, losh*, Pb.; *Loja*, Sutlej; *Lodra*, Jaunsar; *Lodh, lodo, lawadho*, Garhwal; *Lodh, lodhia*, Kumaon.

A large shrub or small tree. *Bark* light grey, corky, with long vertical cracks. *Wood* white, soft to moderately hard, close-grained, splits and twists in seasoning. *Pores* small, numerous, evenly distributed. *Medullary rays* numerous, fine and very fine. *Annual rings* rather faint.

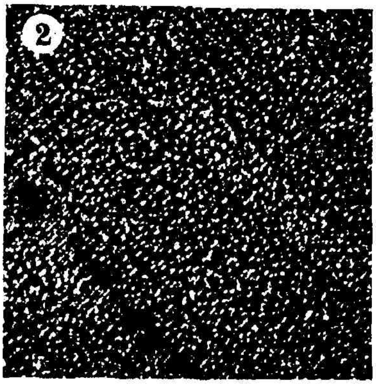
Himalaya, from the Indus to Assam, at 3–8000 ft.; Khasia Hills; hills of Martaban, and the Shan Hills in Burma.

A conspicuous tree in the valleys of the West Himalaya, when covered, in

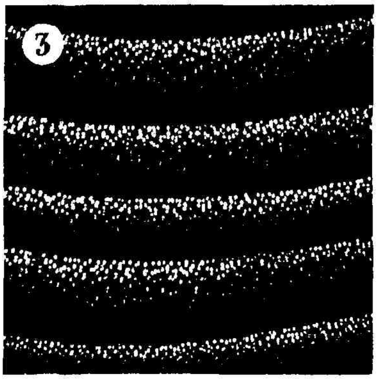
X.



SYMPLOCOS CRATÆGOIDES.



SCHREBERA SWIETENIOIDES.



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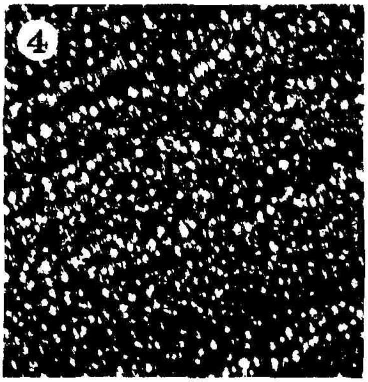
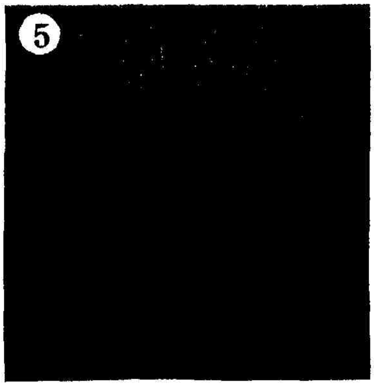
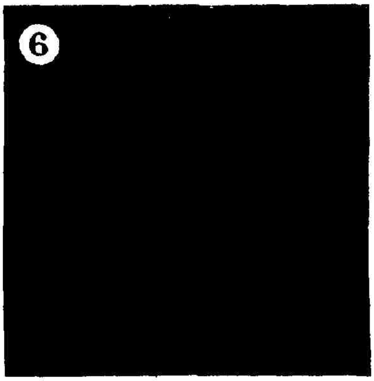


SALVADORA OLEOIDES.



ALSTONIA SCHOLARIS.



CALOTROPIS PROCERA.

(Magnified 3½ times.)

spring, with large masses of pure white flowers, which scent the air for some distance. The wood is white and might be useful in turning and for carvings if carefully seasoned. The leaves and bark give a yellow or red dye. The silkworm *Attacus Atlas*, Linn. feeds on its leaves, with those of other plants. The growth is slow, 15 rings per inch of radius.

		lbs.
H 54.	Nagkanda, Simla, 7000 ft.	54
H 2880.	" " " (Gamble)	—
H 3018.	Kotgarh " " "	—
H 429.	Korwa Forest, Jaunsar, 6000 ft. (Bagshawe)	45

Nordlinger's Sections, vol. 8 (Tab. X. 1).

2. S. spicata, Roxb. Fl. Ind. ii. 541; Fl. Br. Ind. iii. 573; Brandis For. Fl. 300; Bedd. Fl. Sylv. cxlix.; Kurz For. Fl. 146; Gamble Darj. List 53; Talbot Bomb. List 123; Trimen Fl. Ceyl. iii. 104. Vern. *Lodh*, Hind.; *Lodh bholia, búri*, Beng.; *Palyok*, Lepcha; *Boothgani*, Badaga; *Kambli vetti*, Tam.; *Bombu, wal-bombu*, Cingh.

A small evergreen tree. *Bark* light-grey, thin, smooth. *Wood* white, soft, even-grained. *Annual rings* marked by few pores in the autumn wood. *Pores* small, evenly distributed. *Medullary rays* of two classes, few fine short, many very fine.

Throughout a great part of India in the hilly country, in evergreen forests, ravines and sholas; Himalaya from Kumaon to Assam, ascending to 5000 ft.; Eastern Bengal; hills of Tenasserim; Western Ghâts from the Konkan southwards, very common in the Nilgiri sholas above 3000 ft.; hills of Ceylon up to 7000 ft., also very common in shola forest.

The chief Indian species, apparently only used for fuel. The seeds, which have the shape of a small fluted pitcher or "lota," are strung in beads and used to put round children's necks to avert evil (Roxb.). They may be purchased as necklaces at Gya, Benares, Hardwar and similar places. The leaves are used in the Darjeeling Hills to give a yellow dye.

		lbs.
W 3729.	Coonoor, Nilgiris, 6000 ft. (Gamble)	37

No. 12 (new), Vern. *Bombu*, and No. 143 (new), Vern. *Wal-bombu*, Cingh., Ceylon Collection (Mendis), are both said to be *Symplocos spicata*, but the woods have not the structure of *Symplocos*.

3. S. theæfolia, Buch.-Ham.; Fl. Br. Ind. iii. 575; Gamble Darj. List 54. *S. lucida*, Wall.; Kurz For. Fl. ii. 143. Vern. *Kharani*, Nep.; *Chashing*, Bhutia.

A small or moderate-sized evergreen tree. *Bark* thin, brown. *Wood* white, soft, even-grained, structure the same as that of *S. spicata*.

Eastern Himalaya from Nepal to Bhutan, very common at 6–10,000 ft.; Khasia Hills, 4–6000 ft.; drier hill forests of Martaban, at 5–7000 ft.

A very common Darjeeling tree, only used for rough house-posts and fuel, but not very good for that purpose. Growth moderate, 6–11 rings per inch of radius. The stag-beetles *Lucanus Mearesi*, Hope, and *L. cantoris*, Hope, have been found boring its wood in the Darjeeling Hills.

		lbs.
E 2390.	Rangbúl Forest, Darjeeling, 7000 ft. (Gamble)	36

4. S. racemosa, Roxb. Fl. Ind. iii. 539; Kurz For. Fl. ii. 144; Gamble Darj. List 54. Vern. *Dudhi*, Oudh; *Lodh*, Beng.; *Chamlani*, Nep.; *Palyok*, Lepcha; *Kaiday*, Mechi; *Singyan*, Bhutia; *Ludum*, Kól; *Lodh*, Oraon.

A small tree. *Bark* yellow, rough, spongy, ½ in. thick. *Wood* white, soft. *Pores* small, more or less in radial lines, numerous. *Medullary rays* short, moderately broad, numerous.

Sub-Himalayan tract from Kumaon to Assam, up to 2500 ft. or even higher; open and dry forests of Burma up to 3000 ft., including the Shan Hills; Andaman Islands; Chota-Nagpore, common.

Common in the Terai forests and in Chota-Nagpore. The leaves and bark are

considerably used in dyeing, giving yellow and red tints. The bark is also used in medicine. Weight 54 lbs. per cubic foot.

C 3491. Kolhán Forests, Singbhúm (Gamble).

5. **S. glomerata,** King; Fl. Br. Ind. iii. 577; Gamble Darj. List 54. Vern. *Sanu hingo*, Nep.

A small evergreen tree. *Bark* thin, brown. *Wood* white, soft, but strong, in structure the same as that of *S. spicata*.

Eastern Himalaya, in Sikkim and Bhutan, up to 6000 ft., most common in the Terai and lower hills, on banks of streams; Khasia Hills at 2–5000 ft.

E 3347. Darjeeling Hills, 6000 ft. (Gamble).

6. **S. ramosissima,** Wall.; Fl. Br. Ind. iii. 577; Brandis For. Fl. 299, 576; Gamble Darj. List 54. Vern. *Lodh*, Hind.; *Kala kharani, silingi*, Nep.; *Tungchong*, Lepcha.

A small evergreen tree. *Bark* dark red. *Wood* white, soft, even-grained, in structure the same as that of *S. spicata*.

Himalaya, from the Jumna to Bhutan, at 5–8000 ft.; Khasia Hills at 4000 ft. A common Darjeeling tree. Growth moderate, 6 to 9 rings per inch of radius.

		lbs.
E 367.	Rangbúl Forest, Darjeeling, 7000 ft. (Johnston)	37
E 3336.	Rangirúm Forest „ „ (Gamble)	—

7. **S. macrocarpa,** Wight; Fl. Br. Ind. iii. 582.

A small tree. *Wood* white, soft, rather rough. *Pores* small, evenly distributed. *Medullary rays* of two classes, few moderately broad, many very fine between the broad ones.

Hills of Travancore and Tinnevelly, in S. India.

		lbs.
W 4588.	Travancore (Bourdillon).	34

8. **S. foliosa,** Wight; Fl. Br. Ind. iii. 582. *S. nervosa*, Wight; Bedd. Fl. Sylv. cxlix. Vern. *Pal velloday*, Tam.

A moderate-sized or large tree. *Wood* white, soft, even-grained. *Pores* small, unevenly distributed. *Medullary rays* of two classes, few moderately broad and many fine, the former showing a silver grain on a radial section.

Nilgiri Hills, above 6000 ft.; common in shola forests about Ootacamund. The wood is used only for fuel.

		lbs.
W 3880.	Aramby Forest, Ootacamund, 7000 ft. (Gamble) . . .	40

S. dryophila, Clarke; Fl. Br. Ind. iii. 575; Gamble Darj. List 54; Vern. *Lal chandan*, Nep.; *Chandan*, Lepcha, is a tree of the higher hills of Sikkim, at 8–12,000 ft., which in Ed. 1 was referred to as giving a wood streaked with red, the coloured part of which was pounded and used for caste-marks by Nepalese. It seems probable, however, that this wood belongs to *Daphniphyllum himalayense*, Müll. Arg., which *see*, but it is not impossible that both trees have a wood of the character described.

2. STYRAX, Linn.

Four species. *S. rugosum*, Kurz; Fl. Br. Ind. iii. 589; Kurz For. Fl. ii. 141, is an evergreen tree of the Shan Hills and the hills of Martaban at about 4000 ft. *S. polyspermum*, Clarke; Fl. Br. Ind. iii. 590, is a tree of the Khasia Hills. *S. Benzoin*, Dryand. is a small tree of the Malay Archipelago which gives the "Benzoin" or "Gum Benjamin" of commerce. The resin is obtained from incisions in the bark, where it is allowed to harden after exudation, and is then scraped off. It is used in the manufacture of incense both in Europe and in the East, and the trade in it is considerable (see Watt, "Dict. Econ. Prod."). The "Storax" tree of the Levant is *S. officinale*, Linn., but the gum is now very scarce, as the trees have been so badly treated as to have almost disappeared.

1. **S. serrulatum,** Roxb. Fl. Ind. ii. 415; Fl. Br. Ind. iii. 588; Kurz For. Fl. ii. 142; Gamble Darj. List 54. Vern. *Kúm-jameva,* Beng.; *Chamo,* Lepcha.

A small tree. *Bark* thin, grey. *Wood* white, moderately hard, close-grained. *Pores* small, scanty, usually subdivided. *Medullary rays* short, fine, very numerous. Faint, white, regular, concentric, transverse bands.

Eastern Himalaya from Nepal to Assam, up to 9000 ft.; Chittagong Hill Tracts; Upper Burma.

The specimen described is from var. *virgata* (*S. virgatum,* Wall.; Kurz For. Fl. ii. 142), which is found at higher levels than the ordinary kind, and which extends to China and Japan. It gives an inferior kind of gum benzoin.

E 3372. Darjeeling Forests, 6000 ft. (Gamble).

2. **S. Hookeri,** Clarke; Fl. Br. Ind. iii. 589; Gamble Darj. List 54. Vern. *Chamo,* Lepcha.

A small tree. *Bark* thin, grey. *Wood* white, similar to that of *S. serrulatum,* but with more marked transverse bands.

Eastern Himalaya, in Sikkim and Bhutan at 6–7000 ft.

Has larger flowers than the preceding. In both the flowers are white and conspicuous and the plants are decidedly ornamental.

E 3320. Darjeeling Forests, 6500 ft. (Gamble).

ORDER LXX. OLEACEÆ.

An interesting Order containing some trees of importance. There are ten genera, belonging to four Tribes, viz.—

Tribe I. Jasmineæ	Jasminum, Nyctanthes.
„ II. Syringeæ	Schrebera, Syringa.
„ III. Fraxineæ	Fraxinus.
„ IV. Oleineæ	Osmanthus, Linociera Olea, Ligustrum, Myxopyrum.

Wood white or yellowish-white or light brown, sometimes with a dark irregular heartwood, usually close- and even-grained. *Annual rings* usually marked by a continuous belt of comparatively large pores (notably in *Fraxinus, Jasminum,* and *Ligustrum*), the pores in the rest of the wood much smaller. *Pores* sometimes in white patches. *Medullary rays* usually fine, sharply defined. In *Osmanthus* the pores are in reticulate anastomozing patches as in *Rhamnus.* In *Osmanthus, Linociera* and some species of *Olea* there are narrow concentric lines, the relationship of which to annual rings is very doubtful.

1. JASMINUM, Linn.

About 40 erect or scandent shrubs of but little importance, and some quite small. Most of them are noticeable for their white, often fragrant flowers, and some of the species are cultivated in gardens. Thus: *J. Sambac,* Ait., the Arabian Jasmine, is a fragrant shrub, wild and cultivated for its scented flowers, which are largely used by Hindus to make into garlands, they being especially sacred to Vishnu; while *J. grandiflorum,* Linn., the Spanish Jasmine, wild in the inner Himalaya, is found in gardens or growing on houses everywhere. The common white garden Jasmine is *J. officinale,* Linn., which is wild in Kashmir. *J. arborescens,* Roxb. Fl. Ind. i. 95; Fl. Br. Ind. iii. 594; Brandis For. Fl. 311; Talbot Bomb. List 125; Vern. *Barakúnda, nuva-mallika,* Beng.; *Kúndi,* Mar., is a large, usually erect, but sometimes climbing shrub of the sub-Himalayan forests from the Saharanpur Siwaliks to Nepal and of the Deccan and West Coast. *J. scandens,* Vahl; Fl. Br. Ind. iii. 595; Kurz For. Fl. ii. 155; Vern., *Tawsabè,* Burm., is a large evergreen scandent shrub, with light brown wood, common in the forests of Eastern Bengal and Burma. *J. rigidum,* Zenker; Fl. Br. Ind. iii. 598; Vern. *Uti, pedda malli,* Tel., is a rigid, erect shrub of

the forests of the Deccan and Carnatic, common in the evergreen forests of Eastern Cuddapah and North Arcot; also of the Shan Hills in Burma. *J. auriculatum*, Vahl; Fl. Br. Ind. iii. 600; Talbot Bomb. List 125, is a common large climber of the forests of the Deccan and Carnatic.

Wood white, soft. *Pores* small to very small, very numerous. *Medullary rays* very fine. *Annual rings* sometimes prominent.

1. **J. pubescens,** Willd.; Fl. Br. Ind. iii. 592; Roxb. Fl. Ind. i. 91; Gamble Darj. List 54; Talbot Bomb. List 124. *J. hirsutum*, Willd.; Brandis For. Fl. 312; Kurz For. Fl. ii. 154. Vern. *Parirajhar*, Nep.; *Kunda, kundo, chameli*, Hind.

A climbing shrub, the stem spirally twisted in wedges which turn round each other rope-fashion. *Bark* light brown, extremely thin. *Wood* white, moderately hard. *Pores* very small, very numerous, evenly distributed. *Medullary rays* very fine.

Throughout India from the Himalaya to the Deccan and Carnatic; also to Eastern Bengal and Upper Burma.

A handsome plant, with large clusters of white flowers, prominent in the forests and perhaps more so in hedges and among scrub.

D 4270. Kottakota Reserve, Anantapur (Gamble).

2. **J. cordifolium,** Wall.; Fl. Br. Ind. iii. 596.

A large climbing shrub with spirally twisted stems. *Bark* yellow, very fibrous. *Wood* white, soft, porous. *Pores* moderate-sized, unevenly distributed. *Medullary rays* very fine, very numerous.

Nilgiri Hills at 3–6000 ft.

W 3793. Coonoor, Nilgiris, 5000 ft. (Gamble).

3. **J. brevilobum,** A. DC; Fl. Br. Ind. iii. 600.

A large climbing shrub with spirally twisted stems, up to 1 ft. in diameter. *Bark* greyish-brown. *Wood* white, soft, in radial irregular wedges, which are separated by bast tissue, which later decays, so that the wedges separate. *Annual rings* marked by faint lines. *Pores* very small, evenly distributed. *Medullary rays* extremely fine and numerous.

Hills of South India; one of the chief and largest climbers in the sholas of the Nilgiris, Pulneys, etc., at 3–7000 ft.

W 3803, 4125. Fairlawns, Ootacamund, 7000 ft. (Gamble).

4. **J. humile,** Linn.; Fl. Br. Ind. iii. 602; Talbot Bomb. List 125; Trimen Fl. Ceyl. iii. 115. *J. revolutum*, Sims.; Brandis For. Fl. 313. *J. grandiflorum*, Gamble Darj. List 55, *non* Linn. Yellow Jasmine. Vern. *Chamba, júari, tsonu, tsuman, summun, kuja*, Pb.; *Kurang*, Sutlej; *Shanjoi, shunjai*, Jaunsar; *Jai, sonajáhi*, Kumaon.

A small erect shrub. *Bark* thin, grey. *Wood* white, moderately hard, even-grained. *Annual rings* marked by a continuous belt of pores, which are small, while in the rest of the wood they are extremely small. *Medullary rays* extremely fine, very numerous.

Hilly regions of India: Himalaya from Kashmir to Bhutan, at 3–7000 ft.; Mount Abu; hills of South India, common in the Nilgiris; hills of Ceylon: often cultivated, even in the plains.

A handsome shrub, recognized by its yellow flowers. Growth slow, 25 to 40 rings per inch of radius.

		lbs.
H	2891, 3027. Nagkanda, Simla, 7000 ft. (Gamble)	45
H	4790. Thunwara Forest, Tehri-Garhwal, 7000 ft. (Gamble)	—
W	3748. Coonoor, Nilgiris, 6000 ft. (Gamble)	—

Nordlinger's Sections, vol. 7 (*J. revolutum*).

5. **J. grandiflorum,** Linn.; Fl. Br. Ind. iii. 603; Roxb. Fl. Ind. i. 100; Brandis For. Fl. 313; Kurz For. Fl. ii. 150. Spanish Jasmine. Vern. *Chambel, jati,* Hind.; *Hoi-báli,* Jaunsar; *Joi,* Garhwal; *Myatlè,* Burm.

A climbing shrub. *Wood* white, soft. *Pores* small, evenly distributed. *Medullary rays* very fine, very numerous.

West Himalaya, from Kashmir to Nepal, at 3-9000 ft.; hills of Burma: often cultivated. Flowers white.

H 2879, 3026. Nagkanda, Simla, 8000 ft. (Gamble).

2. NYCTANTHES, Linn.

1. **N. Arbor-tristis,** Linn.; Fl. Br. Ind. iii. 603; Roxb. Fl. Ind. i. 86; Bedd. Fl. Sylv. t. 240; Brandis For. Fl. 314; Kurz For. Fl. ii. 155; Talbot Bomb. List 126. Vern. *Har, siháru, saihiári, sanihari, harsinghar, haringar, saherwa, seoli, nibári,* Hind.; *Pakúra, ladúri, kúri,* Pb., N.-W. Provinces; *Harsinghar, sephalika,* Beng.; *Sháli,* Meywar; *Khersári, kirsaru,* Gondi; *Lewassi,* Jeypore; *Kirsahar,* Baigas; *Samsihár,* Kharwar; *Saparúng,* Kól, Sonthal; *Gongo seoli, godokodika,* Uriya; *Dor, kalangreti,* Khond; *Paritjak, khúrasli,* Mar.; *Karassi,* Bhíl; *Hursing,* Kan.; *Manjapu, paghala, pavazha,* Tam.; *Poghada, karchiá,* Tel.; *Seikbalu,* Burm.; *Sépala, sépalika,* Cingh.

A small tree. *Bark* ¼ in. thick, light brown, rough. *Wood* pale red or pale yellowish-brown, moderately hard, close-grained. *Pores* small, grouped in short radial lines, but arranged more or less in concentric rings, the *annual rings* apparently marked by a dark line and a more complete ring of pores. *Medullary rays* very fine to fine, very numerous, the distance between them equal to the transverse diameter of the pores. Transverse bars very numerous, faint, irregular.

Sub-Himalayan forests, Siwalik Hills and dry lower Himalayan Hills up to 5000 ft., from the Chenab to Nepal; Assam and Bengal; Central India from the Ganges to the Godavari; scarce in Burma: elsewhere cultivated only.

A well-known tree with fragrant flowers, which open at night and drop off in the morning. Wild, it is generally met with as a thick bushy shrub, but if allowed to grow it becomes a small tree. The wood is only used for fuel, for which it is excellent. The leaves are rough and can be used for polishing. The yellow tubes of the corollas give an orange dye. The flowers are often used for garlands, are employed in Hindu ceremonies, and give the colour used for the robes of Buddhist priests (Trimen). In the reclothing of bare hills, this shrub is probably destined to play a considerable part. It is an important constituent of the undergrowth in the Siwalik and Lower Himalayan forests, for it densely covers the ground, helps to form humus, is not usually eaten by goats, and gives an excellent fuel. It could probably be easily reared by seed-dibbling, in denuded places where it was found desirable to introduce by degrees some growth of a forest nature, provided that some shade either of a natural or artificial character could be given to the seedlings at first.

		lbs.
C 3412.	Hazaribagh, Chota Nagpore (Gamble)	55
C 3492.	Kolhán, Singbhúm ,, ,,	—

3. SCHREBERA, Roxb.

S. swietenioides, Roxb. Fl. Ind. i. 109; Fl. Br. Ind. iii. 604; Bedd. Fl. Sylv. t. 248; Brandis For. Fl. 305; Kurz For. Fl. ii. 156; Talbot Bomb. List 126. Vern. *Moka, góki, ghant, gantha,* Hind.; *Patali, ghanta parali,* Bandelkhand; *Jantia, nemiburo,* Uriya; *Makkam, mokob, mokalapu, galla,* Tel.; *Mogalinga,* Tam.; *Ghattár,* Baigas; *Karindi, mokha, dhakka,* Gondi; *Jhán,* Kurku; *Mokkak,* Bhíl; *Kalgante,* Coorg; *Kasira,* Sonthal; *Guntera,* Mal Pahari; *Gaterh,* Koderma; *Ghato,* Ovaon; *Ghanto,* Kharwar; *Jarjo, sundapsing,* Kól; *Moko,* Khond; *Moké,* Koya; *Mokapa,* Reddi; *Thitswèlwè,* Burm.

A deciduous tree. *Bark* grey, ¼ in. thick, exfoliating in thin irregular scales. *Wood* brownish-grey, hard, close-grained; no defi-

nite heartwood, but irregular masses of purple or claret-coloured wood in the centre, and scattered throughout the tree. *Annual rings* indistinct. *Pores* small, often in small groups in radial arrangement. *Medullary rays* fine, numerous, uniform and at equal distances, conspicuous as narrow plates in the silver-grain.

Various parts of India in deciduous forest: Kumaon Terai, in the south-east corner; Central India in Bandelkhand, C.P., Berar, Chota Nagpore, extending to the western coast, and to Orissa and the Circars; Deccan and Carnatic; dry forests in Burma, extending to the Shan Hills.

A widely spread tree, found abundantly in some regions, but scarce in others. The wood is durable and of good quality, in grain rather like boxwood. Brandis and Beddome say it is used for the beams of weavers' looms, for combs and in turning. Weight about 57 lbs. per cubic foot.

			lbs.
C	829.	Bairagarh Reserve, Berar (Drysdale)	59
C	2772.	Melghát, Berar (Brandis)	—
C	193.	Mandla, Central Provinces (1870)	51
C	1108.	Ahiri Reserve, Central Provinces (R. Thompson)	—
C	1410.	Moharli „ „ „ (Brandis)	—
C	3454.	Ramundag Reserve, Palamow (Gamble)	—
B	1413.	Burma (Ribbentrop)	59
B	3149.	„ (Brandis, 1862)	54
W	4079.	Mudumalai Forest, Nilgiris, 3000 ft. (Gamble)	60

Nordlinger's Sections, vol. 10 (Tab. X. 2).

4. SYRINGA, Linn.

Two species. The garden Lilac, extensively cultivated in Europe and occasionally in Indian gardens, is *S. vulgaris*, Linn.

1. S. persica, Linn.; Fl. Br. Ind. iii. 604; Brandis For. Fl. 306. Persian Lilac. Vern. *Hiásmin*, Kashmir.

A shrub. *Wood* white, smooth, even-grained. *Annual rings* marked by a belt of small pores in the spring wood, *pores* in the rest of the wood very small, very numerous. *Medullary rays* fine, short, numerous.

Wild in Waziristan at 8000 ft., elsewhere cultivated. The Persian Lilac has only once been found in the Himalaya in an apparently wild state, viz. by Dr. J. L. Stewart. It is hardy in Europe.

Nordlinger's Sections, vol. 8.

2. S. Emodi, Wall.; Brandis For. Fl. 306. Himalayan Lilac. Vern. *Ban phúnt*, *ban dakhúr*, *banchir*, *razli*, *juari*, *rangkrún*, *kehimu*, *lolti*, *leila*, *shafri*, *shapri*, *duden*, *shalanghar*, *chilanghati*, Pb.; *Shafroi*, Jaunsar; *Ghia*, Kumaon; *Tworshing*, Byáns.

A large shrub. *Bark* grey, $\frac{1}{10}$ in. thick. *Wood* smooth, hard, with a small, dark-coloured heartwood. *Annual rings* well marked by a narrow porous belt. *Pores* small in the spring wood, very small and rather scanty in the autumn wood. *Medullary rays* fine, numerous.

Safed-koh; West Himalaya from the Indus to the Sarda, at 8–11,000 ft.

A common shrub in some of the higher Himalayan forests, hardy in Europe. Growth slow, 20 rings per inch of radius.

		lbs.
H	2911, 3023. Nagkanda, Simla, 8–9000 ft. (Gamble)	59

Nordlinger's Sections, vol. 8.

5. FRAXINUS, Linn.

Four species. *F. Griffithii*, Clarke; Fl. Br. Ind. iii. 605, is a tree of the Mishmi Hills. *Wood* white. *Annual rings* usually marked conspicuously by

a belt of larger pores, very visible on a vertical section. *Medullary rays* fine, numerous, sometimes very short.

1. **F. floribunda**, Wall.; Fl. Br. Ind. iii. 605; Brandis For. Fl. 302, t. 37. Vern. *Banárish*, Afgh.; *Súm, súmb, sunnu, shún, húm, hamu*, Pb.; *Angan, angon, ango, dakkúri*, N.-W. Provinces; *Kangu, tahási*, Nep.

A large deciduous tree. *Bark* grey, corky, with longitudinal furrows. *Wood* white, with a light red tinge, no heartwood, soft to moderately hard. *Annual rings* marked by an almost continuous line of large pores, those in the outer part of the annual rings smaller. The large pores of the annual rings are well defined on a longitudinal section. *Medullary rays* fine, numerous, giving the wood a handsome silver-grain.

Baluchistan, Afghanistan; Himalaya, from the Indus to Sikkim, between 5000 and 8500 ft., only locally common; Shan Hills of Upper Burma at 4000 ft.

A valuable tree "confined to rich moist soils, generally in the neighbourhood of 'limestone rocks. It attains an average height of 40 ft., and girth of 5 ft., but has 'been neglected till recently. It seeds profusely, and although germination requires 'the entire space of 12 months, it reproduces fairly well on loose soil, free from weeds. 'It is also capable of very easy artificial production" (Fernandez in "Naini Tál W. Plan"). Brandis says that trees planted near villages and temples on the Chenab reach 120 ft. in height and a girth of 15 ft. Growth slow to moderately fast, averaging 13 rings per inch of radius for our specimens; Wallich says 8 rings (Brandis). Weight 48 lbs. per cubic foot. The wood is tough and hard, and is used for oars, jampan poles, ploughs and other purposes.

		lbs.
H 612.	Parbatti Valley, Kulu, 7000 ft. (Pengelly)	47
H 904.	Upper Chenab, 8000 ft. (Baden-Powell)	—
H 2971.	Naini Tál (Brandis)	49
H 3190.	Dungagalli, Hazara, 7000 ft. (Wild)	—

2. **F. excelsior**, Linn.; Fl. Br. Ind. iii. 606; Brandis For. Fl. 303. The Ash. *Frêne*, Fr.; *Esche*, Germ.; *Frassino*, Ital. Vern. *Súm, kúm*, Pb.

A large tree. *Bark* grey, thick. *Wood* white, moderately hard. *Annual rings* marked by a belt of large pores in the autumn wood, in the rest of the wood the *pores* are scanty and decrease in size to very small. *Medullary rays* fine, numerous, making a silver-grain on a radial section, which, with the well-marked streaks caused by the pores, at once characterizes this well-known wood.

West Himalaya from the valley of the Ravi westwards at 4–6000 ft. Throughout Europe.

The Ash has been so fully treated in all European works, and is, after all, so unimportant in Indian Forestry, that it seems unnecessary to say much about it and its timber. The weight of the latter varies from 43 to 51 lbs. or even more. The wood is tough and elastic and used for oars and tool-handles and many other purposes.

Nordlinger's Sections, vol. 1 (Europe) (Tab. X. 3).

No. 2974. Europe (Brandis).

3. **F. xanthoxyloides**, Wall.; Fl. Br. Ind. iii. 606. *F. Moorcroftiana*, Brandis For. Fl. 304. Vern. *Shang*, Afgh.; *Hanúz, múch, shilli, chúj, siju, chúm, thúm, sanjal, sandal, shangal, bútru*, Pb.; *Anga, gaha*, N.-W. Provinces; *Thelka*, Kumaon; *Regcha*, Bhutia.

A large shrub or small tree. *Bark* ¼ to ½ in. thick, ashy-grey, smooth; said to be much cracked when old. *Wood* white, moderately hard, close-grained. *Pores* small, grouped in the annual ring, in the rest of the wood in more or less obliquely concentric short strings, the patches rather distant. *Medullary rays* fine, short, numerous.

Baluchistan, Afghanistan, Chitral; West Himalaya from Kashmir to Kumaon, locally abundant in various places on dry slopes.

This small tree is often gregarious, and of slow growth. The wood is hard, and is used for tool-handles, walking-sticks and fuel. Experiments made at Kandahar by Capt. Call, R.E., with pieces 1′ × 1″ × 1″, gave W = 32·2 lbs. and P = 641 ("Ind. Forester," v. 480). It seems to be there called "*Banafsh*," or "Violet Wood." It is a common and important tree in the Baluchistan forests, and the protection given by the formation of Reserved Forests has resulted in improved growth and the appearance of many seedlings. It was formerly much pollarded for fodder, and the old trees still bear trace of the practice.

		lbs.
No. —,	Dauli River, E. Kumaon (Mr. N. F. Troup).	
H 4873.	Hazara, Punjab (Elliott)	47

6. OSMANTHUS, Lour.

1. **O. fragrans,** Lour.; Fl. Br. Ind. iii. 606; Gamble Darj. List 55. *Olea fragrans*, Thunb.; Roxb. Fl. Ind. i. 105; Brandis For. Fl. 309. Vern. *Shilling*, *silang*, Kumaon; *Tungrung*, Lepcha.

A small evergreen tree. *Bark* brown, rough. *Wood* white, hard, close- and even-grained. *Pores* in irregular light-coloured patches, radially elongated, arranged obliquely and branching; the patches somewhat distant and forming a network, and the pores small and numerous in them. White, very narrow parallel concentric lines which look like annual rings, but are not. *Medullary rays* fine, uniform.

Himalaya, from Garhwal to Bhutan at 4–7000 ft., doubtfully indigenous west of Nepal; Khasia Hills—extending to China and Japan. Often planted in gardens.

A very sweet-scented tree, the flowers having the scent of apricots. These flowers are used in China to flavour tea, and in Kumaon to protect clothes from insects. The structure of the wood is like that of most species of *Rhamnus*.

		lbs.
O 4523.	Forest School Garden, Dehra Dún	52
	Nordlinger's Sections, vol. 9.	

2. **O. suavis,** King; Fl. Br. Ind. iii. 607; Gamble Darj. List 55. Vern. *Silingi*, Nep.; *Chashing*, Bhutia.

A small evergreen tree. *Bark* grey. *Wood* hard, white, the structure the same as that of *O. fragrans,* but the pore-patches somewhat broader and the concentric bands much fainter and reddish-coloured instead of white.

Eastern Himalaya in Eastern Nepal and Sikkim at 9–10,000 ft., common on Mount Tonglo near Darjeeling.

This has yellowish-white, speckled twigs and purple, plum-like fruits.

		lbs.
E 379.	Tonglo, Darjeeling, 10,000 ft. (Johnston)	53

7. LINOCIERA, Swartz.

About twelve species, of which one is from the Assam-Burma region, three are from Burma and one from the Andamans; three from South India and three from Ceylon.

L. Wightii, Clarke; Fl. Br. Ind. iii. 608 (*Olea linocieroides*, Bedd. Fl. Sylv. clii.), is a small tree of the Western Ghâts from the Wynaad southwards. *L. purpurea*, Vahl; Fl. Br. Ind. iii. 608; Trimen Fl. Ceyl. iii. 116; Vern. *Kattimuruchan*, Tam.; *Geriata*, Cingh., is a small tree very common in the dry region of Ceylon; while *L. albidiflora*, Thw. and *L. leprocarpa*, Thw. are also Ceylon trees, the latter extending across to the Tinnevelly Ghâts. *L. pauciflora*, Clarke; Fl. Br. Ind. iii. 609 (var. *palembanica*; *Chionanthus palembanicus*, Kurz For. Fl. ii. 159), is an evergreen tree of the coast forests of the Andamans. *L. terniflora*, Wall.; Fl. Br. Ind. iii. 610 (*Olea terniflora*, Kurz For. Fl. ii. 157), is an evergreen tree of the tropical and mixed forests of Chittagong and Burma with a pale brown rather heavy wood. *L.*

insignis, Clarke (*Chionanthus montanus*, Kurz For. Fl. ii. 159) and *L. minutiflora*, Clarke (*Ch. minutiflorus*, Kurz For. Fl. ii. 159) are trees of the hills of Martaban and Tenasserim. *L. caudata*, Coll. and Hemsl.; Journ. Linn. Soc. xxviii. 84, is a small tree of the Shan Hills Terai at 3000 ft.

Wood yellowish-white or light brown, hard, close-grained. *Pores* small, usually in short radial groups. *Medullary rays* fine or very fine, distinct, numerous. Fine, fairly regular concentric lines prominent.

1. **L. malabarica**, Wall.; Fl. Br. Ind. iii. 607. *Chionanthus malabaricus*, Wall.; Bedd. Fl. Sylv. cliv.; Talbot Bomb. List 126. Vern. *Punisi*, *punagam*, Teb.; *Esumuko*, Khond; *Chedda neredi*, Reddi.

A small tree. *Wood* creamy-white or yellowish-white, very hard, close-grained, with a satiny lustre. *Pores* small, single or in short radial lines. *Medullary rays* very fine, white, very numerous. Narrow, fine, white concentric lines, like annual rings, fairly numerous.

Forests of the Western Gháts from the Konkan southwards; also on the Eastern Gháts in the Pullampet Taluk of Cuddapah.

A fine wood, very like boxwood.

	lbs.
D 3844. Kodùr, Cuddapah (Gamble)	65

2. **L. intermedia**, Wight; Fl. Br. Ind. iii. 609; Talbot Bomb. List 126. *Chionanthus intermedius*, Bedd. Fl. Sylv. t. 239. *C. dichotomus*, Roxb. Fl. Ind. i. 108. Vern. *Deorkuda*, Kól.

A large tree. *Bark* ¼ in. thick, light yellowish-brown. *Wood* white, moderately hard, close-grained. *Pores* moderate-sized, often in pairs or threes, scanty. *Medullary rays* fine, numerous, equidistant. Fine concentric lines as in *L. malabarica*.

Western Gháts of the Konkan; Eastern Gháts from Chota Nagpore through Orissa, the Circars, Deccan and Carnatic; hills of South India, especially the Nilgiris and Anamalais up to 6000 ft.

	lbs.
C 3486. Kolhán Forests, Singbhúm (Gamble)	—

3. **L. macrophylla**, Wall.; Fl. Br. Ind. iii. 610. *Chionanthus macrophyllus*, Kurz For. Fl. ii. 159.

A small tree. *Bark* brown, ½ in. thick. *Wood* pinkish-white, moderately hard. *Pores* small, single or in short radial lines. *Medullary rays* fine, numerous, bent where they touch the pores.

Eastern Bengal and Burma, in tropical forests.

O 3211. Saharanpur Botanic Garden (Duthie) cult.

8. OLEA, Linn.

Six species. *O. dentata*, Wall.; Fl. Br. Ind. iii. 613; Kurz For. Fl. ii. 157, is an evergreen tree of the drier hill forests and the hill Eng forests of Martaban and Tenasserim, at 2–3000 ft.; also (var. *salicifolia*, Wall.) of the Khasia Hills, with a pale or dark brown, heavy, close-grained wood. *O. Gamblei*, Clarke; Fl. Br. Ind. iii. 613; Gamble Darj. List 55; Vern. *Jamu*, Nep., is a small tree of the lower hills of Darjeeling, found in valleys near Pankabari at about 2–3000 ft. *O. polygama*, Wight; Fl. Br. Ind. iii. 613; Trimen Fl. Ceyl. iii. 118 (*O. Gardneri*, Thw.; Bedd. Fl. Sylv. cliv.), is a small tree of the Sispara Ghát forests of the Nilgiris and the hills of Ceylon above 4000 ft.

Wood hard, with a distinct heartwood in a few species. *Pores* small to moderate-sized, numerous, subdivided or in short radial groups. *Medullary rays* uniform, equidistant, fine or very fine. Concentric lines in some species.

1. **O. ferruginea,** Royle Ill. 257, t. 65; Brandis For. Fl. 576. *O. cuspidata,* Wall.; Fl. Br. Ind. iii. 611; Brandis For. Fl. 307, t. 38. Indian Olive. Vern. *Khwan, shwan,* Trans-Indus; *Zaitún,* Afgh.; *Ko, kohu, kao, kau, wi,* Pb.; *Kau,* Jaunsar; *Kahu, khau,* Sind.

A moderate-sized deciduous tree. *Bark* grey, thin, smooth when young, when old exfoliating in long narrow strips. *Wood* very hard, smooth, close- and even-grained: sapwood whitish; heartwood large, regularly shaped, from light brown or olive-brown to nearly black, clouded. *Annual rings* sometimes marked by a belt of closely packed *pores,* those in the rest of the ring very small, in irregular patches of soft tissue. *Medullary rays* fine, uniform, very numerous, equidistant. Concentric lines very narrow, white, irregular, as in *Linociera.*

Sind, Suliman Range, Salt Range; West Himalaya, extending as far as the Jumna eastwards, and ascending to 6000 ft., sometimes gregarious.

This important and useful hill tree is chiefly found near villages and in valleys, partly in forest, partly on the borders of fields. It is prized by the villagers and rarely cut down, but regularly lopped, so that it gets a rounded crown. Weight 65 to 82 lbs. per cubic foot, averaging 73 lbs. Brandis says that Sind wood weighs 65 lbs., but his specimen from the Sind Hills reaches 82 lbs. The wood polishes well and is highly prized for turning, for combs, agricultural implements and fuel. The fruit is eaten, but is rarely found on the trees owing to the fondness of crows for it. Oil has been extracted from it, but only in small quantities, though of good quality. The wood is worth trying as a substitute for boxwood or for the wood of the European olive and for inlaying work, as it is often prettily marbled.

		lbs.
P 2729.	Hills of Sind (Brandis)	82
H 162.	Shahpur (Stewart, 1866)	65
H 118.	Vaziri-Rupi, 4000 ft. (Stenhouse)	73
H 779.	Chamba, 3500 ft. (Pengelly)	71
H 425.	Koti Forest, Jaunsar, 6000 ft. (Bagshawe)	75
H 4806.	Tiuni, Tons Valley, Jaunsar, 3000 ft. (Gamble)	75

2. **O. europæa,** Linn. The Olive. *Olivier,* Fr.; *Ulivo,* Ital.

A moderate-sized tree. *Bark* thin, brown, rough. *Wood* very hard, close- and even-grained: sapwood whitish, heartwood irregular, from light brown to dark brown and black, streaked and clouded. *Annual rings* indistinct. *Pores* small, single or subdivided, or in small groups in patches of loose tissue. *Medullary rays* fine, numerous, wavy, short.

Occasionally cultivated in India. Indigenous in Syria.

The wood is described here as, some time ago, many endeavours were made to introduce the tree, chiefly into the Punjab. Little is apparently known of the results of the experiments (see also B. H. Baden-Powell, in "Ind. Forester," xxv. 380). It was also tried in the Dún, but though there are trees alive, they are not thriving. It has also been tried on the Nilgiris. The wood is valuable in Europe, and used in turning, etc. The fruit gives the most valuable of oils. Mathieu gives the weight of the wood at 52 to 70 lbs. per cubic foot.

		lbs.
D 4761.	Bombay (?)	53

Nordlinger's Sections, vol. 2.
Hough's American Woods, vol. viii. No. 186.

3. **O. glandulifera,** Wall.; Fl. Br. Ind. iii. 612; Bedd. Fl. Sylv. t. 238; Brandis For. Fl. 309; Trimen Fl. Ceyl. iii. 118. *O. paniculata,* Roxb. Fl. Ind. i. 105. Vern. *Gúlíli, raban, síra, phalsh,* Pb.; *Gair, gaild,* Garhwal; *Galdu, garúr, gainda,* Kumaon; *Gadúli,* Dotiál; *Kunthay,* Badaga.

A moderate-sized tree. *Bark* ⅓ in. thick, grey, uneven, exfoliating in brittle scales. *Wood* reddish-grey, hard. *Annual rings* marked

by a distinct line. *Pores* moderate-sized, oval, subdivided, uniformly distributed. *Medullary rays* fine, numerous, prominent on a radial section.

Outer Himalaya from the Indus to Nepal, between 2500 and 6000 ft.; Nilgiri and Anamalai Hills in South India; moist region of Ceylon at 2–5000 ft.

In the Western Himalaya, this tree is chiefly found in shady ravines, like those of the Malkot Hills of Dehra Dún, and along rivers, as in the lower Tons valley; in the Nilgiris it is scarce, but affects sholas like those about Avalanché. A section of a tree 43 years old, in the Botanic Gardens, Calcutta, showed 43 rings on a radius of 10 in. (*Brandis*); this would give 4·3 rings per inch or fast growth: the specimens give 12 to 33 rings per inch of radius. Weight, on an average, 56 lbs. per cubic foot. The wood is durable, takes a good polish and is not liable to be eaten by insects.

		lbs.
H 928.	Hazara, 3000 ft. (Baden-Powell)	59
H 2940.	Suni, Simla, 3000 ft. (Gamble)	55
H 222.	Garhwal Hills (1868)	50
W 3883.	Ootacamund, Nilgiris, 7000 ft. (Gamble)	61

4. **O. dioica**, Roxb. Fl. Ind. i. 106; Fl. Br. Ind. iii. 612; Bedd. Fl. Sylv. cliii.; Kurz For. Fl. ii. 157; Gamble Darj. List 55; Talbot Bomb. List 126. Vern. *Attajam*, Beng.; *Kala kiamoni*, Nep.; *Timbernyok*, Lepcha; *Koli, payar*, Tam.; *Parr jamb, burra-nuge, mudla*, Kan.; *Karamba, edana*, Mar.; *Parava idalei, man idalei*, Trav. Hills.

A moderate-sized tree. *Wood* light reddish-brown, hard, rather rough; *annual rings* indistinct. *Pores* moderate-sized, enclosed in rings of pale tissue and arranged in radial somewhat oblique strings. *Medullary rays* very fine, numerous. Concentric wavy lines broader than in *O. ferruginea*, and more frequent.

Eastern Himalaya in the Darjeeling lower hills; Assam, Eastern Bengal, Chittagong; forests of the Western Ghâts from the Konkan southwards.

		lbs.
W 4681.	Travancore (Bourdillon)	48

9. LIGUSTRUM, Linn.

Eleven species, all very closely allied to each other, and some very difficult to distinguish apart, especially those of the Nilgiris. *L. robustum*, Blume; Fl. Br. Ind. iii. 614 (*Phillyrea robusta*, Roxb. Fl. Ind. i. 101, *Olea robusta*, Kurz For. Fl. ii. 158); Vern. *Bhúimúra*, Sylhet, is a large shrub, or sometimes a tree (a large evergreen tree (Kurz), of Eastern Bengal and Burma. *L. Roxburghii*, Clarke; Fl. Br. Ind. iii. 615 (*L. robustum*, Bedd. Fl. Sylv. cliv.) is a small tree of the hills of the Western Ghâts, common about Coonoor on the Nilgiris. *L. Walkeri*, Dcne.; Fl. Br. Ind. iii. 614; Trimen Fl. Ceyl. iii. 119, is a shrub or small tree of the hill region of Ceylon at 3–5000 ft., also found in the Nilgiris. *L. Decaisnei*, Clarke is also a small tree of the Nilgiris and other hills of South India. *L. Massalongianum*, Vis. and *L. Myrsinites*, Dcne. are shrubs of the Khasia Hills at 3–5000 ft. *L. confusum*, Dcne.; Fl. Br. Ind. iii. 616; Gamble Darj. List 55, is a small tree of the higher ranges of the Eastern Himalaya, and the Khasia Hills. *L. nepalense*, Wall.; Fl. Br. Ind. iii. 617 (*L. bracteolatum*, Brandis For. Fl. 310, probably also *L. robustum*, Hook f. and Th.; Brandis For. Fl. 310); Vern. *Keri, banpatara*, Hind.; *Mercha*, Kumaon; *Keri*, Nep., is a small or moderate-sized tree of the Central Himalaya from Garhwal to Nepal, also of the Shan Hills in Upper Burma. The European Privet is *L. vulgare*, Linn. *L. lucidum*, Aiton, is a handsome evergreen Chinese shrub often cultivated in India.

Wood white, even-grained. *Pores* small. *Medullary rays* fine, numerous. *Annual rings* sometimes marked by a continuous line of larger pores.

1. **L. neilgherrense**, Wight; Fl. Br. Ind. iii. 615; Talbot Bomb. List 127. Vern. *Koli*, Badaga; *Kungin*, Mar.

A small tree. *Bark* thin, greyish-white. *Wood* white, moderately hard, with a satiny lustre. *Pores* small, often in radial lines or triangular groups of three. *Medullary rays* fine, numerous.

Higher parts of the Western Ghâts of the Konkan and North Kanara, extending southwards to the Nilgiri Hills, at 5–8000 ft.

W. 3863. Ootacamund, 7000 ft. (Gamble).

2. **L. Perrottetii,** A. DC; Fl. Br. Ind. iii. 615; Bedd. Fl. Sylv. cliii.

A shrub. *Bark* brown, smooth. *Wood* white, moderately hard, structure similar to that of *L. neilgherrense.*

Hills of South India, common in the Nilgiris on the banks of streams like the Pykara and Kundahs rivers.

W 3743. Coonoon, Nilgiris, 6000 ft. (Gamble).

3. **L. compactum,** Hook. f. and Th.; Fl. Br. Ind. iii. 616; Brandis For. Fl. 310. Vern. *Kakurcha*, Jaunsar.

A large shrub or small tree. *Bark* grey, smooth, with rounded lenticels, thin. *Wood* white, moderately hard, close- and even-grained. *Annual rings* marked by a continuous belt of small *pores;* in the rest of the wood the pores are extremely small, regularly distributed, but rather scanty. *Medullary rays* fine and very fine, numerous.

Western Himalaya from the Beas to the Sarda at 3–6000 ft.

This much resembles a large plant of the European Privet. It is found along streams. Growth slow, 17 rings per inch of radius.

		lbs.
H 3059.	Koti, Simla, 6000 ft. (Gamble)	64
H 4779.	Harianta Forest, Jaunsar, 7000 ft. (Gamble)	53

10. MYXOPYRUM, Bl. *M. smilacifolium,* Blume; Fl. Br. Ind. iii. 618; Kurz For. Fl. ii. 160; Gamble Darj. List 55 is an evergreen large scandent shrub of the forests of the Sikkim Terai, Eastern Bengal, Chittagong, Martaban and South India.

ORDER LXXI. SALVADORACEÆ.

Three Indian genera, Dobera, Salvadora, and Azima. The Order resembles OLEACEÆ, but the flowers have four stamens instead of two only.

1. DOBERA, Juss. *D. Roxburghii,* Planch.; Fl. Br. Ind. iii. 619; Talbot Bomb. List 127 (*Blackburnia monadelpha,* Roxb. Fl. Ind. i. 415) is a large tree of the hills of the Northern Circars, said by Roxburgh to have a thin bark, yellowish-green outside, deep red within. In the Fl. Br. Ind. it is only recorded from Bombay, but Talbot says he does not know it. Roxburgh says the wood is "white, close-grained and durable, 'the natives employ it for a variety of purposes." It is noticeable that while the Fl. Br. Ind. gives the leaves as "opposite," Roxburgh calls them "alternate," so that there may be some mistake about it. It seems to be a rare tree, and I do not think I ever met with it in the Circar Mountains.

2. SALVADORA, Linn.

1. **S. persica,** Linn.; Fl. Br. Ind. iii. 619; Roxb. Fl. Ind. i. 389; Brandis For. Fl. 315; Talbot Bomb. List 128; Trimen Fl. Ceyl. iii. 120. *S. Wightiana,* Bedd. Fl. Sylv. t. 247. The Tooth-brush tree. Vern. *Arák, irak,* Arab.; *Kabbar, kharidjar, pilu,* Sind; *Jhál,* Rajputana; *Pillu,* Jeypore; *Charlijál,* Merwara; *Kauri ván, kauri-jal, jhár, jhit,* Pb.; *Opa, ughai, uvay, viyay,* Tam.; *Waragu-wenki, ghunia, waragogu,* Tel.; *Pílu, pilva, khakhin,* Mar.

A small evergreen tree. *Bark* thin, grey. *Wood* white, soft. *Pores* small, in short radial lines, enclosed in oval patches of soft

tissue, very scantily distributed, but prominent on a vertical section. Numerous, fine, interrupted, concentric bands of soft tissue, separating broader bands of firm texture, in which the fine and numerous *medullary rays* are distinctly visible.

Dry regions of India, especially on saline soils, and often on black cotton soil: Sind, Baluchistan, the Punjab and Rajputana; the valley of the Ganges about Delhi and Agra; Guzerat, the Konkan and other parts of the Bombay Presidency; the Circars, Deccan and Carnatic; the dry, especially coast, regions of Ceylon.

The tree is generally small, but in favourable circumstances attains 30 to 40 ft., with a short trunk, often crooked and fluted, 8 to 10 ft. long and 4 to 5 ft. in girth. Specimens have been seen with as much as 14 ft. 9 in. in girth. It is most common in open places near villages, in hedges, on tank bunds, and in similar localities. Weight 40·5 lbs. (Dalzell); 46 lbs. (Fenner); the specimens enumerated give 38 to 45 lbs. The wood is very little used, and is not even a good fuel. The twigs are used as tooth-cleaners; the root bark is very acrid, and acts on the skin like a blister; the shoots and leaves are pungent, but are considered as an antidote to poison, they are eaten as salad and given as fodder to camels; the fruit also is pungent, bitter and aromatic, and is used medicinally, or, with the leaves and shoots, as a relish; the seeds give an oil.

The tree is readily reproduced from seed and coppices well, but the growth is slow (Brandis).

		lbs.
P 1381.	Sind	38
D 4204.	Kistna District (Gamble)	45
	Nordlinger's Sections, vol. 11.	

2. S. oleoides, Dcne.; Fl. Br. Ind. iii. 620; Brandis For. Fl. 316, t. 39; Talbot Bomb. List 128. Vern. *Kabbar, jhár, diár, mithidiár,* Sind; *Jál, vān, vāni, mithi vān,* Pb.; *Jhal,* Hind.; *Pílu,* Mar.

A large evergreen shrub or tree. *Bark* ¼ in. thick, whitish-grey, tessellated. *Wood* light red, moderately hard, with a small, irregular, purple heartwood. *Pores* large and small, oval, often subdivided, surrounded by irregular patches of soft tissue, which are joined into wavy, irregular, zigzag, concentric bands; scanty, but much more numerous and prominent than in *S. persica,* prominent on a vertical section. *Medullary rays* fine, numerous, distinct, at unequal distances.

Sind and Punjab, often forming the greater part of the vegetation of the desert; ascends to 3000 ft. in the Trans-Indus Hills, and to 2400 ft. in the Salt Range.

This tree sometimes grows to a considerable size, and W. Coldstream, in "Economic Products of the Desert Tracts of Mozuffergarh" (*Agri.-Hort. Soc. Calc.* xiii. 1864), mentions a *Jhál* tree 14 ft. in circumference. He says that, the foliage being thick, the tree affords good shade for cattle, and that the dried fruit (*Khokar*) resembles currants. There can be no doubt that the tree is a very important one for reclothing bare and desert tracts in the Sind-Punjab region. If protected, as in the Sibi forests, the growth comes on well and rapidly covers the ground, becoming sometimes almost impenetrable. The wood is sometimes used for building and agricultural implements, Persian wheels and the knee timbers of boats; it is a bad fuel, and leaves a great deal of ash. Weight 49 lbs. (Brandis); specimens mentioned below give 54 lbs. (Punjab) and 38 lbs. (Sind). The fruit is sweet and is eaten; in times of scarcity it has proved of considerable value to the poorer classes in Sind. The seeds give a greenish oil, used, as also are the leaves and bark, in native medicine. The branches are lopped for camel-fodder, but other animals do not eat them.

		lbs.
P 942.	Multán (with heartwood) (Baden-Powell)	54
P 1382.	Sind (no heartwood)	38
	Nordlinger's Sections, vol. 10 (Tab. X. 4).	

3. AZIMA, Lamk.

Two species, erect or rambling thorny shrubs. *A. sarmentosa*, Benth.; Fl. Br. Ind. iii. 620, is an erect shrub of Upper Burma extending thence as far south as Prome. It is probably, as suggested by Collett and Hemsley (*Journ. Linn. Soc.* xxviii. 85), the species described in Kurz For. Fl. ii. 161, as *A. tetracantha*.

1. A. tetracantha, Lamk.; Fl. Br. Ind. iii. 620; Talbot Bomb. List 128; Trimen Fl. Ceyl. iii. 121. *Monetia barleriorides*, L'Hér.; Roxb. Fl. Ind. iii. 765. Vern. *Trikanta-juti*, Beng.; *Kanta-gúr-kamai*, Hind.; *Tella upi*, Tel.; *Sukkaput, kandali*, Mar.; *Iyanku, ichanku*, Tam.; *Katuniyadu, wel-dehi*, Cingh.

A straggling thorny shrub. *Bark* light brown, rough. *Wood* white, soft, consisting of concentric layers in which the pores, surrounded by white loose tissue, are alternately scanty and many. *Pores* small to moderate-sized. *Medullary rays* white, broad.

Orissa, the Circars and Deccan, common all down the Coromandel coast; dry region of Ceylon.

A good hedge-plant. The leaves and bark are used in native medicine, for various diseases. The white berries are eaten.

C 3785. Berhampore, Ganjam (Gamble).

ORDER LXXII. APOCYNACEÆ.

A large Order containing 37 Indian woody genera, most of which are of comparatively little importance in Forest Economy. A few genera, however, produce trees, such as *Alstonia, Holarrhena, Wrightia*, all with white soft woods used for carvings and turnery. *Cerbera* and *Ochrosia* are important constituents of the tidal forests. *Carissa* gives thorny bushes with hard wood, common in the dry regions and bearing edible fruits. *Allamanda, Thevetia* and *Plumeria* afford handsome garden plants. Most of the rest are climbers, some, like *Beaumontia*, of very large size; and some affording caoutchouc of variable quality. The members of the Order mostly have opposite leaves and milky juice, and some of them are poisonous. To this Order belong the species of *Landolphia* known as "Accra Rubber" plants, the "Lagos rubber" plant, *Funtumia elastica*, Stapf, the species of *Kickxia* and perhaps other India-rubber producing plants of importance.

The genera belong to three Tribes, viz.—

Tribe I. Carisseæ	Allamanda, Willoughbeia, Chilocarpus, Melodinus, Winchia, Carissa.
„ II. Plumerieæ . . .	Rauwolfia, Alyxia, Hunteria, Thevetia, Cerbera, Ochrosia, Kopsia, Rhazya, Plumeria, Ellertonia, Alstonia, Holarrhena, Tabernæmontana, Parsonsia.
„ III. Echitideæ	Vallaris, Pottsia, Wrightia, Nerium, Strophanthus, Urceola, Parameria, Beaumontia, Chonemorpha, Ecdysanthera, Aganosma, Epigynum, Rhynchodia, Trachelospermum, Anodendron, Ichnocarpus, Micrechites.

Wood white, soft to hard, even-grained, rarely with heartwood *Pores* small or very small (larger in climbers), scanty, in short or lon radial groups. *Medullary rays* very fine, very numerous. Occasion light concentric lines as in *Alstonia*.

TRIBE I. CARISSEÆ.

1. ALLAMANDA, Linn.

1. A. cathartica, Linn.; Kurz For. Fl. ii. 164; Trimen Fl. Ceyl. iii. 124. Ver *Wal-rukattana*, Cingh.

An evergreen straggling shrub. *Wood* soft, light brown. *Pores* small, in long radial strings, sometimes interrupted; the *annual rings* marked by a belt of somewhat larger ones. *Medullary rays* very fine to fine, rather variable in width, many regular very fine ones alternating with few fine.

Cultivated in gardens and often found run wild; originally from America. Tidal backwaters of the West Coast (Bedd.); low country of Ceylon (Trimen); village shrubberies in Burma (Kurz).

Nordlinger's Sections, vol. 8.

2. WILLOUGHBEIA, Roxb.

Two species. *W. ceylanica*, Thw.; Fl. Br. Ind. iii. 624; Bedd. Fl. Sylv. clvi.; Trimen Fl. Ceyl. iii. 123; Vern. *Kiri-wel*, Cingh., is a large woody climber of the moist forests of Ceylon up to 4000 ft., giving a kind of caoutchouc of no use as india-rubber, and locally employed only as a sort of birdlime to catch insects in paddy-fields. It has also an edible fruit.

1. **W. edulis,** Roxb. Fl. Ind. ii. 57; Fl. Br. Ind. iii. 623; Kurz For. Fl. ii. 165. *W. martabonica*, Wall.; Kurz For. Fl. ii. 165. Vern. *Luti-am*, Beng.; *Thitchauknwè*, *talaing-no*, Burm.

A large climbing shrub. *Bark* dark brown, ½ in. thick, wrinkled in longitudinal folds. *Wood* yellow, soft, porous. *Pores* large and very large, thick-walled, in radial or oblique lines. *Medullary rays* fine, not numerous, indistinct, bent round the pores.

Assam, Eastern Bengal, Chittagong and Burma.

The fruit is edible. Kurz says the plant gives an inferior kind of caoutchouc, and Roxburgh that it yields "a viscid juice, which, by exposure to the open air, is changed into an indifferent kind of elastic rubber."

Chittagong—Kew Museum (J. D. Hooker).

3. CHILOCARPUS, Blume. *C. atro-viridis*, Bl.; Fl. Br. Ind. iii. 626 (*C. malabaricus*, Bedd. Fl. Sylv. clv., *Winchia atro-viridis*, Kurz For. Fl. ii. 170), is a large evergreen climbing shrub of Tenasserim as well as of the moist forests of South Kanara and Malabar, where it is common on the Carcoor Ghát at 2000 ft. (Bedd.).

4. MELODINUS, Forst. Two species. *M. monogynus*, Roxb. Fl. Ind. ii. 56; Fl. Br. Ind. iii. 629, is a tall milky climber of the Sikkim Himalaya, Assam, the Khasia Hills and Sylhet. *M. khasianus*, Hook. f., occurs in the Khasia Hills at 5-7000 ft.

5. WINCHIA, A. DC. *W. calophylla*, A. DC; Fl. Br. Ind. iii. 630; Kurz For. Fl. ii. 170, is an evergreen shrub of Martaban, apparently scandent.

6. CARISSA, Linn.

Five species of thorny shrubs, three of which are erect and two climbing. The three erect species are variable and difficult to distinguish. *C. paucinervia*, A. DC; Fl. Br. Ind. iii. 631 (*C. Carandas*, var. *paucinervia*; Bedd. Fl. Sylv. clvii.), is a thorny shrub of the Nilgiri Hills, recognized by its narrower acute leaves. *C. suavissima*, Bedd.; Fl. Br. Ind. iii. 632, is a climber of the hills of Madura.

1. **C. Carandas,** Linn.; Fl. Br. Ind. iii. 630; Roxb. Fl. Ind. i. 687; Bedd. Fl. Sylv. clvi.; Brandis For. Fl. 320; Kurz For. Fl. ii. 169; Talbot Bomb. List 129; Trimen Fl. Ceyl. iii. 124. Vern. *Karaunda, karaun, karúnda, korinda, garinga, timukhia, gotho*, Hind.; *Kurumcha, kurunda, bainchi*, Beng.; *Kalivi, kalli, kalikai*, Tel.; *Karekai, heggarjigé*, Kan.; *Kalaaha, perunkila*, Tam.; *Karwand, hartundi*, Bombay; *Kenda keri, kerendo kuli*, Uriya; *Kan*, Burm.; *Mahakaramba*, Cingh.

A large shrub or small tree. *Bark* yellowish-brown, peeling off in square flakes. *Wood* white; heartwood irregular greyish- or orange-yellow, streaked, hard, smooth, close-grained. *Pores* small, irregularly distributed. *Medullary rays* fine, short, numerous.

Dry forests in Oudh, Gorakhpur, Bengal, South India, the Konkan and Kanara; also in Burma and Ceylon: often cultivated.

The wood is used as fuel, and spoons and combs are made of it, especially at Udayagiri in Nellore, equally with that of *C. spinarum*, which is similar. The thorny branches are used for fencing. The fruit is excellent, especially for making tarts and preserves.

D 4159. Pidugurála, Palnád, Kistna (Gamble). I believe this to be correctly identified; my Orissa specimens seem all to belong to *C. spinarum.*

2. **C. spinarum**, A. DC; Fl. Br. Ind. iii. 631; Talbot Bomb. List 129; Trimen Fl. Ceyl. iii. 125. *C. diffusa*, Roxb. Fl. Ind. i. 689; Bedd. Fl. Sylv. clvii.; Brandis For. Fl. 321; Kurz For. Fl. ii. 169. *C. hirsuta*, Roth; Kurz For. Fl. ii. 169. Vern. *Garaunda, garna*, Kashmir; *Karaunda*, Hind.; *Gán, garna, garinda*, Punjab; *San karúnda, anka koli*, Uriya; *Kolongda*, Koderma; *Wakoilu, kalikai*, Tel.; *Karawán*, Sonthal; *Kanuwán*, Oraon; *Chirukila, kilatti*, Tam.; *Hin-karamba*, Cingh.

A small thorny evergreen shrub. *Bark* thin, light yellowish-grey, fibrous. *Wood* hard, smooth, close-grained, sapwood white, heartwood irregular, grey or brown or orange-brown, or even black, streaked. *Annual rings* marked by an interrupted line of small pores, *pores* in the rest of the wood small and very small, rather scanty. *Medullary rays* very fine, very numerous.

Dry country throughout India: in the Himalaya from Kashmir and the Punjab eastwards to Sikkim, where it is only found on dry aspects on the outer hills of Sivoke; thence southwards, especially in the Circars, Deccan and Carnatic; dry region of Ceylon; Upper Burma; coast of South Andaman (Kurz).

A well-known and rather important forest bush: in spite of its being greedily eaten by sheep and goats it persists on the poorest, rockiest of soils, and is an important element in any attempt to reafforest such lands. It is often gregarious, "here and 'there forming underwood in forests of bamboo in the Siwalik tract, of *Pinus longifolia* 'in Kangra, of teak in Saugor" (Brandis), and very common on the laterite hills of the Circars and Carnatic. The wood is used, with that of *C. Carandas*, for turning articles such as the carved spoons of Udayagiri in Nellore; it closely resembles boxwood and is made into combs. J. L. Stewart says the old wood is used as a medicine. It is an excellent fuel. The thorny branches are very largely used for fencing fields, and the fruit is eaten and makes good tarts. The growth is slow, 8 to 15 rings per inch of radius.

	lbs.
P 112. Bhajji, Simla, 4000 ft.	—
O 4938. Saharanpur Siwaliks (Gradon)	56
C 3649. Itkuri, Hazaribagh (Gamble)	—
C 3511, 3518, 3569. Khurdha Forests, Orissa (Gamble)	—

3. **C. macrophylla**, Wall.; Fl. Br. Ind. iii. 631; Talbot Bomb. List 129. *C. Dalzellii*, Bedd. Fl. Sylv. clvii.

A large erect or climbing shrub with long strong recurved thorns. *Bark* brown, rough, peeling off in small flakes. *Wood* white, soft. *Pores* moderate-sized, evenly distributed. *Medullary rays* very fine, numerous.

Evergreen forests of the Western Coast from the Konkan southwards to Tinnevelly, abundant about Carwar, Coorg and the Nilgiris.

The Fl. Br. Ind., Beddome and Talbot all speak of this as erect, Beddome even speaks of it as a small tree, but on the Nilgiris I have only seen it straggling or climbing. It is possible that my plant may be *C. suavissima*, Bedd.; Fl. Br. Ind. iii. 632; Talbot Bomb. List 130, which Talbot considers only a variety of *C. macrophylla*, but the Nilgiri plant has long, strong curved thorns, not "very small spines," as *C. suavissima*

is said to possess. The fruit is edible, said to be superior to that of *C. Carandas* (Bedd.); and the milky juice gives a sort of caoutchouc, but only in very small quantities.

W 3817. Coonoor, Nilgiris, 6000 ft. (Gamble).

Tribe II. PLUMERIEÆ.

7. RAUWOLFIA, Linn. About seven species, small shrubs, only two of which are noticeable. *R. serpentina*, Benth.; Fl. Br. Ind. iii. 632; Kurz For. Fl. ii. 171; Gamble Darj. List 55; Talbot Bomb. List 130; Trimen Fl. Ceyl. iii. 126 (*Ophioxylon serpentinum*, Willd.; Roxb. Fl. Ind. i. 694; Bedd. Fl. Sylv. clvi.); Vern. *Chandra*, Beng.; *Patalgani*, Tel.; *Harki, hadaki*, Mar.; *Eka-weriya, rát-ekaweriya*, Cingh., is a small shrub of the undergrowth of Indian forests and in savannahs from the Dehra Dún eastwards and southwards. *R. densiflora*, Benth.; Fl. Br. Ind. iii. 633; Talbot Bomb. List 130; Trimen Fl. Ceyl. iii. 126 (*Ophioxylon densiflorum*, Wall.; Bedd. Fl. Sylv. clvi.), is a rather large shrub of the forest undergrowth in the Khasia Hills and in the hills of South India and Ceylon. *R. canescens*, Linn. is a West Indian shrub cultivated in Indian gardens and often found run wild, as at Madras.

8. ALYXIA, Br. About six species, shrubs or climbers of no importance. *A. gracilis*, Benth.; Fl. Br. Ind. iii. 634, is a climbing shrub of the Darjeeling Terai and the Khasia Hills. *A. ceylanica*, Wight; Fl. Br. Ind. iii. 636; Trimen Fl. Ceyl. iii. 127, is a shrub of the moist low country of Ceylon. *A. stellata*, Roem. and Sch.; Fl. Br. Ind. iii. 636 (*Gynopogon stellatum*, Labill.; Kurz For. Fl. ii. 176), is a climbing shrub of the rocky shores of Tenasserim and the Andamans.

9. HUNTERIA, Roxb.

1. **H. corymbosa**, Roxb. Fl. Ind. i. 695; Fl. Br. Ind. iii. 637; Trimen Fl. Ceyl. iii. 128. *H. zeylanica*, Retz; Bedd. Fl. Sylv. t. 265. *H. Roxburghiana*, Wight; Bedd. Fl. Sylv. clviii. *Gynopogon lanceolatum*, Kurz For. Fl. ii. 177. Vern. *Médiya*, Cingh.

A small tree. *Bark* light brown, thin, smooth except for occasional irregular excrescences. *Wood* brownish-yellow, very hard, close- and even-grained. *Pores* small, numerous, regularly distributed. *Medullary rays* fine and very fine, numerous.

Eastern coast of the Carnatic; Tavoy in Burma; moist low country of Ceylon.

The leaves are used to apply to wounds. The wood has been used in Ceylon for wood-engraving.

Ceylon—Kew Museum (W. Ferguson).

10. THEVETIA, Linn.

1. **T. neriifolia**, Juss.; Kurz For. Fl. ii. 168. Yellow Oleander. Vern. *Zard kunel, pila kanér*, Hind.; *Kolkaphúl*, Beng.; *Payaungban*, Burm.

A large shrub or small tree. *Bark* thin, greyish-brown, shining. *Wood* grey, moderately hard. *Pores* very small and small, numerous. *Medullary rays* very fine, very numerous, the distance between them less than the transverse diameter of the pores.

Cultivated in gardens everywhere in the plains of India and in Burma and Ceylon, one of the most common of garden plants, and often found run wild; native of the W. Indies.

This exceedingly common garden plant is at once recognized by its narrow leaves and yellow flowers, and it is curious that it should not be mentioned by Roxburgh, Brandis, Talbot or Trimen, all of whom mention other introduced plants which are by no means so common. The milky juice of the tree is highly poisonous, and the bark is occasionally used as a febrifuge, but must be employed with caution. The seeds give a bright yellow oil, which burns well without much smoke, and is used in medicine. The tree is very easily propagated, and can be grown as a hedge-plant.

C 3496. Chaibassa, Chota Nagpore (Gamble).

11. CERBERA, Linn.

2. **C. Odollam,** Gaertn.; Fl. Br. Ind. iii. 638; Roxb. Fl. Ind. i. 692; Bedd. Fl. Sylv. clvii.; Brandis For. Fl. 322; Kurz For. Fl. ii. 171; Talbot Bomb. List 130; Trimen Fl. Ceyl. iii. 128. Vern. *Dabúr, dhakur,* Beng.; *Odolam, sukanu,* Mar.; *Kada má, kat arali,* Tam.; *Othalam,* Mal.; *Gon-kaduru,* Cingh.; *Kalwa,* Burm.

A moderate-sized evergreen tree. *Wood* grey, very soft, spongy. *Annual rings* marked by a sharp line. *Pores* small, in short radial lines. *Medullary rays* indistinct.

Coast forests of India, Ceylon and Burma, very common.

Growth fast, 5 to 7 rings per inch of radius. The wood is only occasionally used for firewood. The seeds give an oil which is used for burning.

	lbs.
E 400. Sundarbans (Richardson)	21

12. OCHROSIA, Juss. *O. borbonica,* Gmel.; Fl. Br. Ind. iii. 638; Bedd. Fl. Sylv. clviii.; Trimen Fl. Ceyl. iii. 129, t. 60 (*O. salubris,* Bl.; Kurz For. Fl. ii. 172); Vern. *Mudu-kaduru,* Cingh., is a moderate-sized evergreen tree of the tidal forests of South India, Ceylon and the Andaman Islands. It is very like *Cerbera Odollam,* and the large fruits, "especially when the outer skin is removed and the stringy endocarp only is 'seen, are not distinguishable from those of that species" (Prain), but the small flowers and opposite leaves at once separate it when seen growing. Trimen says it is a more decidedly maritime species than *C. Odollam,* and that it is full of thick milky juice which is extremely viscid.

The wood of a specimen from Réunion in the Kew Museum has: *wood* yellow, moderately hard, even-grained; *pores* small, regularly distributed; *medullary rays* moderately broad, not numerous, indistinct.

13. KOPSIA, Blume.

1. **K. fruticosa,** A. DC; Fl. Br. Ind. iii. 639. *Cerbera fruticosa,* Roxb. Fl. Ind. i. 691. *Calpicarpum Roxburghii,* G. Don; Kurz For. Fl. ii. 178. Vern. *Salat,* Burm.

A large evergreen shrub. *Wood* white, soft, even-grained. *Pores* small, scanty, subdivided or in short radial strings. *Medullary rays* fine, numerous, regular.

Tropical forests of Burma; often planted in Indian gardens.

Singapore—Kew Museum (Ridley).

14. RHAZYA, Dcne. *R. stricta,* Dcne.; Fl. Br. Ind. iii. 640; Brandis For. Fl. 322; Talbot Bomb. List 131; Vern. *Sewar, sihar, ishwarg,* Sind; *Vargalum,* Pushtu; *Gandera,* Trans-Indus; *Vena,* Salt Range, is a small glabrous stout shrub of the plains country of Sind, the trans-Indus Districts, Baluchistan and Afghanistan. The leaves are given as fodder to goats, after they have been steeped in water for some days to remove the bitterness; and the fruit and leaves are used in native medicine. The wood is used for fuel. The dried fruit is employed in Baluchistan as a rennet to coagulate milk.

15. PLUMERIA, Linn.

Introduced trees. *P. alba,* Jacq. is common in gardens and near temples about the older towns of India, as at Madras, and is recognized by its thick reticulate leaves and large white flowers. *P. rubra,* Linn. of the West Indies gives the perfume known as "Frangipani."

1. **P. acutifolia,** Poiret; Fl. Br. Ind. iii. 641; Brandis For. Fl. 323; Kurz For. Fl. ii. 179; Gamble Darj. List 55; Talbot Bomb. List 131; Trimen Fl. Ceyl. iii. 130. *P. acuminata,* Roxb. Fl. Ind. ii. 20. The Pagoda tree, or Temple tree. Vern. *Gul achin, golainchi, chameli,* Hind.; *Khair champa, son champa,* Bombay; *Champa pungár,* Gondi; *Gulijbar,* Sonthal; *Chin champa,* Monghyr; *Kanagala,* Kan.; *Kuppa-alarie,* Tam.; *Alariya,* Cingh.; *Tayôk saga,* Burm.

A fleshy deciduous small tree. *Bark* thick with smooth outer

layer, grey, shining, exfoliating in small flakes. *Wood* yellowish-white, soft. *Pores* small, in short radial groups, rather scanty. *Medullary rays* fine, numerous.

Cultivated throughout India, Burma and Ceylon: native country unknown (see Brandis, Trimen, etc.).

A very common and conspicuous garden plant, frequently met with about temples. It very rarely fruits, but is easily propagated by cuttings. Attempts have been made, but unsuccessfully, to make caoutchouc of the milk. The flowers, which are white outside, pale yellow within, are very fragrant and are made into garlands. Graham Anderson says the wood is good for native drums, otherwise I have never heard of its use for any purpose, but it is by no means very bad.

		lbs.
O 4521.	Dehra Dún (Gamble)	37

16. ELLERTONIA, Wight. *E. Rheedii*, Wight; Fl. Br. Ind. iii. 641; Talbot Bomb. List 131, is a climbing shrub of the Western Ghâts.

17. ALSTONIA, Br.

Three or four species. *A. venenata*, Br.; Fl. Br. Ind. iii. 642; Bedd. Fl. Sylv. clx.; Talbot Bomb. List 131, is a handsome shrub of the forests of South India, in North Kanara, the eastern slopes of the Nilgiris at 3–5000 ft. and elsewhere. It is very close to *A. neriifolia*, Don. *A. Kurzii*, Hook. f.; Fl. Br. Ind. iii. 643 (*A. spectabilis*, Kurz For. Fl. ii. 183), is a large evergreen tree of the Andaman Islands, reaching 100 ft. in height and a girth of 6 to 7 ft., but very closely allied to *A. scholaris*.

1. **A. scholaris**, Br.; Fl. Br. Ind. iii. 642; Bedd. Fl. Sylv. t. 242; Brandis For. Fl. 325; Kurz For. Fl. ii. 183; Gamble Darj. List 55; Talbot Bomb. List 131; Trimen Fl. Ceyl. iii. 133. Vern. *Chatwan, chatinn*, Beng.; *Satiún, chatiún, satwin, satni*, Hind.; *Lationj*, Kumaon; *Chatiwan*, Nep.; *Purbo*, Lepcha; *Satiána*, Ass.; *Chhatiána*, Uriya; *Chhatni*, Sonthal; *Chhatin*, Mal Pahari; *Chatni, bomudu*, Kól; *Chochnia*, Khond; *Satwin, saptaparni*, Mar.; *Sattni*, Cachar; *Pala, wodrase, elilaippalai, mukampalei*, Tam.; *Eda-kula, pala garuda*, Tel.; *Mukampala, elila-pala, kodapala*, Mal.; *Janthalla, mudhol, kodale*, Kan.; *Rukattana*, Cingh.; *Chaile, chalain*, Magh; *Taungmeòk, taungsaga, lettôk*, Burm.

A large evergreen tree. *Bark* dark grey, somewhat rough, lenticellate. *Wood* white, soft, even-grained, seasons badly, and soon gets mouldy and discoloured if allowed to season in log. *Pores* moderate-sized, oval, subdivided, ringed, scanty. *Medullary rays* fine, wavy, irregularly distributed, with numerous intermediate extremely fine rays. Numerous, fine, wavy concentric lines at unequal distances.

Throughout the moister regions of India, but nowhere very common: sub-Himalayan tract from the Jumna eastwards, ascending to 3000 ft.; Eastern Bengal and Assam; deciduous forests of Burma, extending north to Myitkyina; Western and Southern India; low country of Ceylon.

A handsome tree with whorled branches and smooth, shining, milky, parallel-veined leaves.

Weight 28 lbs. per cubic foot; Brandis gives 40 lbs., and Kyd (*Echites scholaris*) 40·5 lbs. and P = 710. Bourdillon gives W = 27 lbs. P = 416. The wood is not durable, but is easily worked; it is used for boxes, furniture, scabbards, coffins and other purposes, and is made into blackboards in Burma. It is used occasionally in Darjeeling, Assam and Cachar for tea-boxes. The wood and bark are bitter; the latter is used as a tonic, anthelmintic and antiperiodic.

		lbs.
O 4809.	Bidhalna Forest, Dehra Dún (Gamble)	28
C 4208.	Ganjam Forests (Gamble)	29
E 577.	Khookloong Forest, Darjeeling Terai (Manson)	28
E 718.	Chittagong (Chester)	28
E 1270.	Lakhimpur, Assam (G. Mann)	31
W 863.	South Kanara (Cherry)	28
No. 75, Ceylon Collection (old), No. 121 (new)		26

Nordlinger's Sections, vol. 10 (Tab. X. 5).

2. **A. neriifolia,** Don; Fl. Br. Ind. iii. 642; Gamble Darj. List 55. Vern. *Chatwa*, Nep.; *Purbo*, Lepcha.

A shrub. *Bark* thin, light brown, somewhat corky. *Wood* white, moderately hard, even-grained. *Pores* small, in long radial lines. *Medullary rays* of two kinds, many very fine and occasional broader ones which are very short. *Annual rings* marked by a line of pores and a band of pale tissue.

Eastern Himalaya in Sikkim and Bhutan; Northern Circars.

I have been in doubt about this specimen; it has the leaves of *A. neriifolia* and the fruit of *A. venenata*, but seems to be nearer the former on the whole.

C 3835. Surada Forest, Ganjam (Gamble).

18. HOLARRHENA, Br.

1. **H. antidysenterica,** Wall.; Fl. Br. Ind. iii. 644; Bedd. Fl. Sylv. clx.; Brandis For. Fl. 326, t. 40; Kurz For. Fl. ii. 182; Gamble Darj. List 55; Talbot Bomb. List 132. *H. Codaga*, G. Don; Kurz For. Fl. ii. 181. Vern. *Karra, kaura, kora, kúra, kúar, kari, karchi, dhúdi*, Hind.; *Kor*, Kashmir; *Kogar, kiam*, Pb.; *Kural*, Kumaon; *Kachri*, Oudh; *Samoka, girchi*, Gondi; *Kurakat*, Kurku; *Ankhria*, Bhil; *Dhowda*, Guz.; *Kirra, karingi*, Nep.; *Dudhali, dudhkuri*, Mechi; *Dudcory*, Ass.; *Madmandi*, Gáro; *Patrukurwan, pita korwa, kherwa*, Uriya; *Dowla, kura, indrajau*, Bombay; *Karru*, Jeypore; *Dudhiári*, Berar; *Dudi, kurakhatto*, Melghát; *Korkoria*, Oraon; *Kurchi*, Bhumij; *Kuria*, Kharwar; *Hát*, Sonthal; *Kurdu*, Mal Pahari; *Towa, kuti*, Kól; *Pardali*, Khond; *Pal*, Koya; *Pala*, Reddi; *Vepali, kodagapalei*, Tam.; *Pala, kodaga*, Tel.; *Kurra*, Mar.; *Lettôkkyi, lettôkthein*, Burm.

A small deciduous tree. *Bark* ¼ in. thick, brown, rough, exfoliating in small irregular flakes. *Wood* white, soft, even-grained. *Annual rings* marked by a faint line. *Pores* small, numerous, grouped in radial lines. *Medullary rays* fine, very numerous. Cellular tissue loose.

Throughout India and Burma, ascending in the Lower Himalaya to 3500 ft., and to a similar altitude on the hills of S. India.

One of the most universally widespread of Indian Forest trees, and sylviculturally important as an associate of Sál in Northern and Central India and of Eng in Burma, and as being both one of the last trees to disappear in denuded forests and one of the first to come up on waste lands. This is probably due to its flowering regularly even as a bush or coppice clump, to its producing much seed, which often does not get dispersed until after the fire-season, and to its leaves being distasteful to cattle and goats. It appears also regularly in open grass lands, and is a great help in reclothing those lands under protection from fire, and so paving the way to the appearance and growth of more valuable but more tender and slower-growing species. It coppices abundantly, the shoots, even from burnt stools, growing very strong and quickly.

Growth moderate, 7 to 8 rings per inch of radius. The weight and transverse strength of the wood have been determined by the following experiments:—

	Weight in lbs.	P.
Kyd (1831) in Assam, with bars 2 ft. × 1 in. × 1 in., found (*H. antidysenterica*)	47	417
Kyd (1831) in Assam, with bars 2 ft. × 1 in. × 1 in., found (*H. pubescens*)	34	523
Skinner (1862) in South India, No. 134, found	38	562

The specimens here enumerated give an average of 38 to 39 lbs., and 40 lbs. per cubic foot may be taken as a mean average.

The wood is largely used for carvings, especially in Saharanpur and Bijnor Districts, where tables, picture-frames, paper-knives, toys, spoons, forks, plates, and many other similar articles are made of it; in Assam for furniture; in South India for turning. The bark, leaves, fruits and seeds are used medicinally, the bark as a tonic and febrifuge and in dysentery. Hamilton, in Aikin's List of Wallich's specimens, says beads are made of the wood in Assam to be worn round the neck as a medicine. Brandis says the branches are used for fodder or litter, but I have never, that I can remember, seen them cut for fodder, and my impression is that the leaves are disliked by cattle and goats.

		lbs.
O 4426.	Dehra Dún Forests (Grenfell)	48
O 258, 263.	Garhwal (1868)	33 and 34
O 3083.	Gonda, Oudh	—
C 2801.	Melghát, Berar (Brandis)	36
C 1158.	Ahiri Reserve, Central Provinces (R. Thompson)	—
C 2734.	Moharli " " " (Brandis)	44
C 957.	Guzerat (Shuttleworth)	41
C 3558.	Khurdha Forests, Orissa (Gamble)	—
C 4209.	Ganjam " " (Gamble)	34
No. 52,	Salem Collection (marked *Wrightia tinctoria*)	39

Nordlinger's Sections, vol. 7.

2. **H. mitis,** R. Br.; Fl. Br. Ind. iii. 645; Bedd. Fl. Sylv. clxi.; Trimen Fl. Ceyl. iii. 131. Vern. *Kiriwalla, kiri-mawara,* Cingh.

A rather tall slender tree. *Bark* whitish, smooth. *Wood* white, close-grained, soft, in structure resembling that of *H. antidysenterica,* but the *medullary rays* are much broader.

Ceylon, chiefly in the dry region of the low country.

Both the wood and bark are used as a remedy for fever and dysentery. Mendis says the wood is used for inlaying, ornamental furniture, cabinet work, frames, etc.

	lbs.
No. 46 (old), Ceylon Collection (*Echites lanceolata*), No. 73 (new)	35

19. TABERNÆMONTANA, Plum.

About ten species, mostly evergreen shrubs or small trees with sweet-scented white flowers. *T. crispa,* Roxb. Fl. Ind. ii. 24; Fl. Br. Ind. iii. 639 (*T. alternifolia,* Roxb. Fl. Ind. ii. 24; Kurz For. Fl. ii. 174), is a large shrub of the coast of the Andaman Islands. *T. recurva,* Roxb. Fl. Ind. ii. 26; Fl. Br. Ind. iii. 648; Kurz For. Fl. ii. 174; Vern. *Tawzalat,* Burm., is a shrub of the tropical forests of Chittagong and Burma. Five others are less common Burmese shrubs.

1. **T. dichotoma,** Roxb. Fl. Ind. ii. 21; Fl. Br. Ind. iii. 645; Bedd. Fl. Sylv. clix.; Trimen Fl. Ceyl. iii. 132. Vern. *Divi-kaduru,* Cingh.

A small tree. *Wood* yellowish-white, moderately hard. *Pores* small, often subdivided or in radial strings, unevenly arranged. *Medullary rays* moderately broad, scanty, with several fine ones between.

Forests of the Western Ghâts; moist low country of Ceylon.

Ceylon: Int. Exhn., 1862—Kew Museum.

2. **T. Heyneana,** Wall.; Fl. Br. Ind. iii. 646; Talbot Bomb. List 132. Vern. *Vaglkudó, pandra-kura,* Mar.

A small tree. *Bark* smooth, grey. *Wood* white or light grey. *Pores* very small, in radial lines. *Medullary rays* fine, numerous, short, forming a marked silver-grain.

Western Ghâts, from the Konkan southwards, rising to 4000 ft., in evergreen forests, common in Wynaad.

		lbs.
W 4592.	Travancore (Bourdillon)	36

3. **T. coronaria,** Willd.; Fl. Br. Ind. iii. 646; Roxb. Fl. Ind. ii. 23; Bedd. Fl. Sylv. clix.; Brandis For. Fl. 322; Gamble Darj. List 55; Talbot Bomb. List 132; Trimen Fl. Ceyl. iii. 133. *T. divaricata,* Bl.; Kurz For. Fl. ii. 174. Vern. *Chandui, taggai, taggar, firki-tagar* (single), *bara-tagar* (double), Hind.; *Asuru,* Nep.; *Krim,* Lepcha.

An evergreen shrub. *Bark* silvery grey. *Wood* white, moderately hard, close-grained. *Pores* very small. *Medullary rays* fine, numerous.

Sub-Himalayan tract, from Dehra Dún eastwards; very common in the lower Darjeeling Hills. Cultivated throughout India, Burma and Ceylon.

The Fl. Br. Ind. considers this as not indigenous, but it occurs commonly in the Darjeeling forests, and, indeed, even so far west as the Dehra Dún (Thano), with some appearance of being truly indigenous. It is everywhere cultivated in gardens, where the flowers may be either single or double, and are very fragrant.

Growth fast, 5 rings per inch of radius. The fruit has a red pulp, which may give a dye. The flowers are made into garlands for offerings in Hindu temples.

		lbs.
E 2392.	Sivoke Forest, Darjeeling Terai (Gamble)	47

20. PARSONSIA, R. Br. *P. spiralis*, Wall.; Fl. Br. Ind. iii. 650; Kurz For. Fl. ii. 180; Talbot Bomb. List 132, is an evergreen climbing shrub of Sylhet, Burma and the Western Gháts, common in North Kanara.

Tribe III. ECHITIDEÆ.

21. VALLARIS, Burm.

1. **V. Heynei**, Spreng.; Fl. Br. Ind. iii. 650; Talbot Bomb. List 133; Trimen Fl. Ceyl. iii. 135. *V. dichotoma*, Wall.; Brandis For. Fl. 327; Kurz For. Fl. ii. 181. *Echites dichotoma*, Roxb. Fl. Ind. ii. 19. Vern. *Dudhi, dudhali*, Garhwal, Kumaon; *Happurmali*, Beng.

A large climbing shrub. *Bark* yellowish-grey, peeling off in small rectangular flakes. *Wood* white, soft to moderately hard. *Pores* moderate-sized, arranged radially between the fine to moderately broad *medullary rays*.

Sub-Himalayan tract from the Jumna (perhaps from the Sutlej) eastwards, ascending the lower hills to 5000 ft.; Eastern Bengal and Burma; South India and Ceylon: in dry forests and in hedges and groves, sometimes cultivated.

An extensively climbing plant with handsome flowers, troublesome to forest trees in places, as in the Dehra Dún, where, and in Saharanpur, however the branches are in considerable use for making baskets.

O 4654. Saharanpur Siwaliks (Gamble).
D 4158. Kondapalle Hill, Kistna (Gamble).

22. POTTSIA, Hook. and Arn. *P. cantonensis*, Hook. and Arn.; Fl. Br. Ind. iii. 652; Kurz For. Fl. ii. 190, is an evergreen climbing shrub of Assam, Eastern Bengal and Tenasserim.

23. WRIGHTIA, Br.

About six species, three of which are endemic Ceylon plants. *W. coccinea*, Sims; Fl. Br. Ind. iii. 654; Kurz For. Fl. ii. 193; Gamble Darj. List 56; Vern. *Asari*, Nep., is an evergreen tree of the Eastern Himalaya, the hills of Sylhet and Chittagong and the Shan Hills of Burma, with scarlet flowers and a white close-grained wood used for turning. It is occasionally planted in gardens. *W. angustifolia*, Thw. and *W. flavido-rosea*, Trimen; Trimen Fl. Ceyl. iii. 136, are small trees of the dry region of Ceylon; while *W. zeylanica*, Br.; Fl. Br. Ind. iii. 654; Trimen Fl. Ceyl. iii. 137; Vern. *Wal-idda, sudu-idda*, Cingh., is a slender shrub of the moist low country of Ceylon, very common about Colombo, where its white flowers are used in bouquets.

Wood white, moderately hard. *Pores* small, scanty, in short radial lines. *Medullary rays* very fine, numerous.

1. **W. tinctoria**, Br.; Fl. Br. Ind. iii. 653; Bedd. Fl. Sylv. t. 241; Brandis For. Fl. 324; Kurz For. Fl. ii. 193; Talbot Bomb. List 133. *Nerium tinctorium*, Roxb. Fl. Ind. ii. 4. Vern. *Dhúdi*, Banda; *Khirni*, Rajputana; *Kúra*, Melghát; *Kala kúdu, kala kura*, Mar.; *Tedlápál, repala, palavareni, pullavari, amkudu, pala-parki*, Tel.; *Kod murki*, Kan.; *Pálá, veypalé, nila palei*, Tam.; *Eeccha*, Mal.; *Irumpála, thonda pála*, Travancore Hills.

A small deciduous tree. *Wood* white, moderately hard; even-grained. *Pores* scanty, very small, in short radial lines. *Medullary rays* extremely fine, numerous.

The Peninsula of India, common in the Deccan and Carnatic and the Bombay Presidency, extending north to Rajputana and Banda, in deciduous forest; also in Burma.

This species is easily recognized from the more widely distributed *W. tomentosa* by its follicles being joined only at the tip, while in the latter species they are joined for their whole length. The wood is of good quality for carving and turning, for which it is used, the weight being from 40 (Wallich) to 50 lbs. per cubic foot. Kurz says it resembles ivory. Growth moderate, about 7 rings per inch of radius. The leaves are used in dyeing. The branches are sometimes ringed by a longicorn beetle, *Xylorrhiza adusta*, Wiedem.

		lbs.
P 456, 3222.	Nagpahar, Ajmere	49

2. **W. tomentosa**, Röm. and Sch.; Fl. Br. Ind. iii. 653; Bedd. Fl. Sylv. clix.; Brandis For. Fl. 323; Gamble Darj. List 56; Talbot Bomb. List 133; Trimen Fl. Ceyl. iii. 137. *W. mollissima*, Wall.; Kurz ii. 192. *Nerium tomentosum*, Roxb. Fl. Ind. ii. 6. Vern. *Keor, kiláwa*, Pb.; *Dudhi, dharauli, daira*, Hind.; *Darbela*, Garhwal; *Karingi, kirra*, Nep.; *Selemnyok*, Lepcha; *Pal kurwán*, Uriya; *Harido*, Cuttack; *Dudh-koraiya*, Monghyr; *Igasira*, Sonthal; *Sandikuya*, Kól; *Palsi*, Khond; *Palaperbi*, Koya; *Jula*, Reddi; *Tella pal, koila-mukri*, Tel.; *Kala inderjau, tambara kura*, Mar.; *Atkuri*, Ass.; *Lettôkthein, taungsalat*, Burm.

A small deciduous tree. *Bark* ½ in. thick, grey, corky. *Wood* white, moderately hard, even-grained. *Annual rings* marked by a pale line and occasionally more pores; *pores* in the rest of the wood very small, in short radial groups, scanty. *Medullary rays* very fine and extremely fine, very numerous, closely packed.

Throughout India, chiefly in deciduous forest, extending in the sub-Himalayan tract westwards to the Beas, eastwards to Sikkim; mixed forests of Burma; low country of Ceylon.

The wood is used for turning and carved work, like that of *W. tinctoria* and of *Holarrhena*, especially at Saharanpur. Kyd gives W = 34 lbs., P = 523; Bourdillon gives W = 34 lbs., P. 390; specimens examined give 44½ lbs.: 40 lbs. may probably be taken as the mean. Growth moderate, about 8 rings per inch of radius. The bark of the stem and roots is considered an antidote to snake-bite. Manson says the Nepalese use the milky juice to stop bleeding. The tree is sometimes grown for ornament.

		lbs.
C 830.	Bairagarh Reserve, Berar (Drysdale)	41
D 998.	Poona (Shuttleworth)	48
D 994.	Sahyadri Ghâts, Ahmednagar (Shuttleworth)	49
E 623.	Rakti Forest, Darjeeling Terai (Bonham Carter) . . .	40

24. NERIUM, Linn.

N. Oleander, Linn.; Brandis 329, is the Oleander tree of the Mediterranean, often cultivated in India, and perhaps not specifically distinct from *N. odorum*.

1. **N. odorum**, Solander; Fl. Br. Ind. iii. 655; Roxb. Fl. Ind. ii. 2; Brandis For. Fl. 328; Talbot Bomb. List 133. Vern. *Kanira, kanér, ganhira*, Pb.; *Kaniyúr*, Kumaon.

A large shrub. *Wood* greyish-white, soft. *Pores* very small, in radial lines. *Medullary rays* very fine, very numerous.

North-West and Central India, Sind, Baluchistan, Afghanistan, Outer Himalaya to 5500 feet. Often cultivated.

A common shrub in rocky stream-beds and in ravines in the Lower Western Himalaya, the Siwalik range and elsewhere, with showy flowers and brown silky seeds. The bark and root are poisonous, and the leaves used in native medicine.

		lbs.
H 3057.	Murree Hills, 5000 ft.	37

25. STROPHANTHUS, DC. Three species, one of which is an erect shrub, the others climbers. *S. dichotomus*, DC; Fl. Br. Ind. iii. 655 (*S. longicaudatus*, Wight and *S. Griffithii*, Wight; Kurz For. Fl. ii. 191), is a shrub of Tenasserim, remarkable for the long tails to the corolla-lobes, which are often 2 to 3 or even 5 to 7 in. long. *S. Wallichii*, A. DC is a climbing shrub of the Khasia Hills, Chittagong and the Northern Circars; while *S. Wightianus*, Wall. is a climbing shrub of Malabar and Travancore.

26. URCEOLA, Roxb. *U. esculenta*, Benth.; Fl. Br. Ind. iii. 658; Kurz For. Fl. ii. 184 (*Chavannesia esculenta*, DC); Vern. *Kyetpaung*, Burm. (?), is an evergreen large climbing shrub of Tenasserim. In 1874 this plant was the subject of a "Note on Caoutchouc" by Mr. G. W. Strettell, published in Rangoon, in which the author recommended its cultivation as a producer of indiarubber, and stated that a large amount of excellent rubber was being wasted by the annual cutting of the stems in the Teak forests (see Watt's "Dict. Econ. Products," vol. iv. 361).

27. PARAMERIA, Benth. *P. glandulifera*, Benth.; Fl. Br. Ind. iii. 660; Kurz For. Fl. ii. 189; Vern. *Talaingsôk*, Burm., is an evergreen large climbing shrub of the borders of tidal forests on the coasts of Tenasserim and the Andaman Islands. It is said to give indiarubber of good quality.

28. BEAUMONTIA, Wall.

Three species, large climbers of great size. *B. Jerdoniana*, Wight; Fl. Br. Ind. iii. 661; Talbot Bomb. List 134, is found in the evergreen forests of the Konkan and North Kanara ghâts, and is possibly not distinct from *B. grandiflora*. *B. khasiana*, Hook. f.; Fl. Br. Ind. iii. 661, is found in the Khasia Hills.

1. **B. grandiflora**, Wall.; Fl. Br. Ind. iii. 660; Kurz For. Fl. ii. 179; Gamble Darj. List 56. *Echites grandiflora*, Roxb. Fl. Ind. ii. 14. Vern. *Barbari*, Nep.

A gigantic climber. *Bark* light brown, rough, ¼ in. thick. *Wood* white or light brown, moderately hard, even-grained, tough. *Pores* small to moderate-sized, single or in short radial strings, very scanty. *Medullary rays* extremely fine, indistinct.

Eastern Himalaya from Nepal eastwards, ascending to 4000 ft.; Sylhet and Chittagong; often cultivated as an ornamental climber.

One of the most beautiful plants of the Indian forests, having large, pure white, bell-shaped flowers, handsome foliage, and a large cylindrical capsule, giving out quantities of plumose seeds. The young stems give a fibre. It reaches a great size, grows quickly, and is easily propagated by seed, layers or cuttings.

	lbs.
O 4402. Dehra Dún, 2000 ft. (cult.) (Gamble)	38

29. CHONEMORPHA, G. Don. Two species. *C. macrophylla*, G. Don; Fl. Br. Ind. iii. 661; Brandis For. Fl. 328; Kurz For. Fl. ii. 187; Gamble Darj. List 56; Talbot Bomb. List 134; Trimen Fl. Ceyl. iii. 138 (*Echites macrophylla*, Roxb. Fl. Ind. ii. 13); Vern. *Gar badero*, Kumaon; *Yokchounrik*, Lepcha; *Harki*, Sylhet; *Bu-wal-anguna*, Cingh., is a large milky climbing shrub of moist forests in the greater part of India from Kumaon and Sikkim in the Himalaya to Travancore and Ceylon and the Andaman Islands. It has large pure white flowers, which often show, as a sheet of white, over the tops of tall trees. It gives a kind of caoutchouc. *C. Griffithii*, Hook. f. is a similar climber of the Sikkim Himalaya with even larger flowers.

30. ECDYSANTHERA, Hook. and Arn. *E. micrantha*, A. DC; Fl. Br. Ind. iii. 662 (*E. brachiata*, A. DC; Kurz For. Fl. ii. 189), is a large climbing shrub, common in the Darjeeling Himalaya at 3–5000 ft., Assam, Sylhet, the Khasia Hills and Upper Burma.

31. AGANOSMA, G. Don. About 5 species, climbing shrubs. *A. marginata*, G. Don; Fl. Br. Ind. 663; Kurz For. Fl. ii. 186, is a large evergreen climber of mixed forests in Chittagong and Burma, with a light, pale, close-grained wood. *A. caryophyllata*, G. Don is a large climber of Lower Bengal and the Deccan country, frequent

on the Veligonda Hills of Cuddapah. *A. cymosa*, G. Don; Talbot Bomb. List 134; Trimen Fl. Ceyl. iii. 139, is found in West and South India and Ceylon.

32. EPIGYNUM, Wight. *E. Griffithianum*, Wight; Fl. Br. Ind. iii. 666; Kurz For. Fl. ii. 184, is a large climbing shrub of Tenasserim.

33. RHYNCHODIA, Benth. *R. Wallichii*, Benth.; Fl. Br. Ind. iii. 667 (*Cercocoma Wallichii*, Miq.; Kurz For. Fl. ii. 187), is a lofty evergreen climber of the Sikkim Himalaya at 2500 ft., Assam, Sylhet and Burma.

34. TRACHELOSPERMUM, Lemaire.

Three species, climbing shrubs. *T. gracilipes*, Hook. f. is found in the Khasia Hills; and *T. axillare*, Hook. f. in the Sikkim Himalaya at 4–6000 ft.

1. **T. fragrans**, Hook. f.; Fl. Br. Ind. iii. 667; Gamble Darj. List 56. *Ichnocarpus fragrans*, Wall.; Brandis For. Fl. 327. Vern. *Dudhi*, Kumaon; *Duari*, Nep.; *Yök-chounrik*, Lepcha.

A climbing shrub with very twisted knotty stem marked by horizontal folds and tubercular excrescences. *Bark* grey, $\frac{1}{8}$ in. thick *Wood* white, soft. *Pores* large to very large, often subdivided and in radial or curved strings. *Medullary rays* fine, very numerous.

Himalaya, from Simla eastwards, ascending to 6000 ft.; Assam and Cachar.

This species seems sometimes to climb like ivy. It is not uncommon in the swamps of Dehra Dún, and in deep valleys in Jaunsar and Tehri Garhwal.

		lbs.
O 4452.	Ré nadi, Dehra Dún, 1500 ft. (Gamble)	35

35. ANODENDRON, A. DC. *A. paniculatum*, A. DC; Fl. Br. Ind. iii. 668; Kurz For. Fl. ii. 188; Talbot Bomb. List 135; Trimen Fl. Ceyl. iii. 141; Vern. *Lamtani*, Mar.; *Twinnet*, Burm.; *Dul*, *aswel*, Cingh., is a very large climbing shrub of the forests of Burma, the Western Ghâts and Ceylon, whose stems give a strong fibre, said by Kurz to be used for their bows by the Andamanese, but it is strange that the plant does not seem to be recorded from the Andamans.

36. ICHNOCARPUS, Br.

Three species, two of which occur only in the Khasia Hills and Sylhet.

1. **I. frutescens**, Br.; Fl. Br. Ind. iii. 669; Brandis For. Fl. 327; Kurz For. Fl. 185; Talbot Bomb. List 135; Trimen Fl. Ceyl. iii. 142. Vern. *Siama lota*, Hind.; *Belkamu*, Saharanpur; *Krishnasarwa*, *kantebhouri*, Mar.; *Nalla-tiga*, Tel.; *Korampala*, *kiri-wel*, Cingh.; *Tawsabè*, Burm.

An evergreen extensively climbing shrub, very red-rusty in appearance. *Bark* dark brown with shallow vertical clefts, sometimes greyish-white. *Wood* white, soft. *Pores* moderate-sized to large, numerous. *Medullary rays* fine.

Throughout India and Burma, from the Lower Himalaya at the Sutlej Valley eastwards; Ceylon: in deciduous forests, open shrubby lands and hedges.

One of the commonest of Indian climbing plants. The bark gives a fibre, and the roots and leaves are used in medicine. The twigs are used in Saharanpur for basket-making.

O 4656. Saharanpur Forests, N.-W. Provinces (Gamble).
C 3469. Palamow, Chota Nagpore (Gamble).

37. MICRECHITES, Miq. *M. elliptica*, Hook. f.; Fl. Br. Ind. iii. 671; Gamble Darj. List 56, is a large climbing shrub of the Sikkim Himalaya at 4–6000 ft. and the Khasia Hills. *M. polyantha*, Miq. is found in the Andaman Islands.

ORDER LXXIII. ASCLEPIADACEÆ.

A large Order with well-marked botanical characters. It contains several genera, the representatives of which in India are more or less woody; one or two containing erect and the rest climbing shrubs. Several of the genera have so little importance in Forest economy that I have thought it best merely to select for mention those whose members grow to a fairly large size, or are very common, or of which I have seen wood specimens. Of these there are 12 genera belonging to five Tribes, viz.—

Tribe I. Periploceæ	Cryptolepis, Cryptostegia, Finlaysonia, Periploca.
„ II. Secamoneæ	Secamone.
„ III. Cynancheæ	Calotropis.
„ IV. Marsdenieæ	Gymnema, Marsdenia, Pergularia, Dregea.
„ V. Ceropegieæ	Leptadenia, Orthanthera.

The Order contains many plants with useful fibres and many which are important in medicine.

Wood white, soft or moderately hard. *Pores* usually large, or of various sizes, scanty, radially arranged. *Medullary rays* very indistinct, of all sizes.

1. CRYPTOLEPIS, Br.

1. **C. Buchanani,** Roem. and Sch.; Fl. Br. Ind. iv. 5; Brandis For. Fl. 330; Kurz For Fl. ii. 199; Talbot Bomb. List 136; Trimen Fl. Ceyl. iii. 149. *Nerium reticulatum,* Roxb. Fl. Ind. ii. 8. Vern. *Karanta,* Hind.; *Medka-singki,* Dehra Dún; *Adivi pala tiga,* Tel.; *Wel-rukattana,* Cingh.

A large much-branched climbing shrub. *Bark* when young purplish-red, peeling off in papery flakes; when older brown, rough. *Wood* white. *Pores* large or moderate-sized in radial strings. *Medullary rays* moderately broad.

Throughout the greater part of India, chiefly in deciduous forest and in hedges; more scarce in Burma; Ceylon.

The fibre is said to be used by the natives of the Circar Hills.

O 4657. Saharanpur Forests, N.-W. Provinces (Gamble).
C 3947. Upper Godavari Forests (Gamble).

2. CRYPTOSTEGIA, Br. *C. grandiflora,* Br.; Fl. Br. Ind. iv. 6 (*Nerium grandiflorum,* Roxb. Fl. Ind. ii. 10), is a large climbing shrub, probably native of Madagascar, and frequently cultivated or found run wild in India. It gives a rather good kind of caoutchouc, but is too scarce for the collection of it to be worth making.

3. FINLAYSONIA, Wall. *F. obovata,* Wall.; Fl. Br. Ind. iv. 7; Kurz For Fl. ii. 197, is a large evergreen woody climber of the tidal forests of Burma.

4. PERIPLOCA, Linn.

Three species. *P. hydaspidis,* Falc.; Fl. Br. Ind. iv. 12, is a shrub of the Kashmir and Punjab Himalaya up to 4000 ft. *P. calophylla,* Falc.; Fl. Br. Ind. iv. 12; Brandis For. Fl. 330; Gamble Darj. List 56; Vern. *Párh,* Jaunsar; *Maslara,* Nep.; *Purgeen,* Lepcha, is a small shrub of the Himalaya from the Jumna to Sikkim at 3–6000 ft., and of the Khasia Hills.

1. **P. aphylla,** Dcne.; Fl. Br. Ind. iv. 12; Brandis For. Fl. 330; Talbot Bomb. List 137. Vern. *Barrarra, barre,* Trans-Indus; *Báta,* Pb.

A shrub. *Bark* reddish-brown, smooth, shining. *Wood* white, moderately hard, close-grained. *Pores* moderate-sized, in long wavy radial strings. *Medullary rays* extremely fine, numerous.

Sind, the Trans-Indus Salt Range and Northern Punjab, Baluchistan, Afghanistan. In the desert the wood is used for fuel. The flowers and flower-buds are sweet and are eaten.

P 4479. Baluchistan (Lace).

5. SECAMONE, Br.

1. **S. emetica,** Br.; Fl. Br. Ind. iv. 13; Trimen Fl. Ceyl. iii. 146.

A climbing shrub. *Bark* brown, corky, very thick, deeply cleft and somewhat spirally arranged. *Wood* white, moderately hard. *Pores* small, numerous, evenly distributed. *Medullary rays* very fine, very numerous.

Deccan and Carnatic; dry country of Ceylon.

D 3873. Cuddapah (Gamble).

6. CALOTROPIS, Br.

Three species. Milky shrubs with large flowers, greyish-green leaves and silky seeds. The chief species is *C. gigantea*. *C. procera*, Br.; Fl. Br. Ind. iv. 18; Brandis For. Fl. 331; Kurz For. Fl. ii. 200; Talbot Bomb. List 137; Vern. *Spalwakka*, Afgh.; *Uk*, Sind; *Ak*, *mudár*, Hind.; *Lalmandar*, *tambara*, Mar., is a somewhat smaller species, found in drier regions. It is common in the sub-Himalayan tract from the Indus to the Sarda, in Oudh, Central India, the Deccan and Sind, also in Upper Burma and as far south as Prome. The fibre of the bark and seeds is the same as that of *C. gigantea*, as are its medicinal qualities. The wood is used for charcoal and for brushing the teeth. *C. Acia*, Ham.; Fl. Br. Ind. iv. 18; Gamble Darj. List 56; Vern. *Mudár*, Hind.; *Auk*, Nep., is a shrub of the sub-Himalayan country from the Jumna to Assam, apparently not used, but probably of qualities similar to those of the other two.

1. **C. gigantea,** Br.; Fl. Br. Ind. iv. 17; Brandis For. Fl. 331; Kurz For. Fl. ii. 200; Talbot Bomb. List 137; Trimen Fl. Ceyl. iii. 148. *Asclepias gigantea*, Roxb. Fl. Ind. ii. 30. Vern. *Mudár*, *safed-ak*, Hind.; *Arka*, *akari*, *rowi*, Bombay; *Erukku*, *ukkovi*, *manakkovi*, Tam.; *Jilleda*, Tel.; *Wara*, Cingh.; *Mayo*, Burm.

A large shrub. *Bark* light yellowish-white, corky, deeply cleft vertically. *Wood* white, soft. *Pores* small to moderate-sized, single or subdivided or in groups in radial arrangement, the groups rather scanty. *Medullary rays* few fine very short, alternating with several very fine long.

Sub-Himalayan tract from the Ganges to Nepal, Central and South India, Burma and Ceylon, very common on waste lands, on roadsides, etc.

One of the most widespread and conspicuous of Indian plants, whose value as a fibre-yielder, and as helping to reclothe denuded lands, has been much discussed. Its inner bark gives a valuable fibre of fine silky texture, which is very strong, and is used for bow-strings, fishing nets and lines, and is found to be durable in water. The seeds are surrounded by silky hair, which is said to be made into thread in Borneo. It is difficult to spin, but mixed with one-fifth of cotton it gave, in experiments made by Mr. Monckton in Madras, a good-wearing cloth, capable of being washed and dyed. It is well suited for stuffing pillows. The fibre of the stems was found to bear 552 lbs., against 407 borne by Sunn hemp (*Crotalaria juncea*) and 224 lbs. borne by "coir" (Royle, "Fibrous Plants of India," pp. 306 to 310). The wood is made into gunpowder charcoal in Kattiawar and the Deccan, and the powdered root is used in medicine as an alterative, tonic and emetic. The acrid milky juice is also used for various medicinal purposes.

C 3446. Barasand Reserve, Palamow (Gamble).

C 3512. Burkool, Khurdha, Orissa (Gamble).

In Nordlinger's Sections, vol. 5, is *C. procera* with similar structure (Tab. X. 6). In Africa *C. procera* grows to a very large size, judging by a specimen brought from the Soudan by Mr. C. E. Muriel, which was over 6 in. in diameter. The *bark* was thick, creamy-white, powdery; *wood* as described.

7. GYMNEMA, Br.

Several climbing shrubs, some of considerable size. *G. sylvestre*, Br.; Fl. Br. Ind. iv. 29; Talbot Bomb. List 139; Trimen Fl. Ceyl. iii. 153; Vern. *Kawali*, *kalikardori*, *vakhande*, Mar., is a large climbing shrub of the forests of South India and Ceylon. *G. molle*, Wall. is a large climber of Upper Burma. *G. acuminatum*, Wall.; Kurz For. Fl. ii. 202, is a large climber of Eastern Bengal; while *G. tingens*, W. and A. is an extensive climber of the Himalaya from Kumaon to Sikkim, Assam, Bengal, Burma and South India.

1. **G. hirsutum**, W. and A.; Fl. Br. Ind. iv. 29.

A large climber with spirally twisted stems. *Bark* very rough, brown. *Wood* white, soft, in very irregular indented patches, separated by bast tissue. *Pores* moderate-sized, numerous, regularly distributed in the patches. *Medullary rays* very obscure, scarcely visible.

Rhotas in Behar; Nilgiri Hills at 5-7000 ft.

A common and profusely branching large climber of the Nilgiri sholas. The juice of the leaves prevents sugar being tasted.

W 3802. Fairlawns, Ootacamund, 7000 ft. (Gamble).

8. MARSDENIA, Br.

Ten or eleven species of climbing shrubs. *M. tinctoria*, Br.; Fl. Br. Ind. iv. 34; Brandis For. Fl. 332; Kurz For. Fl. ii. 201; Gamble Darj. List 56; Talbot Bomb. List 139 (*Asclepias tinctoria*, Roxb. Fl. Ind. ii. 43); Vern. *Kalilara*, Nep.; *Ryôm*, Lepcha, is a large climbing shrub of the Sikkim Himalaya, Assam, the Khasia Hills, Northern Burma and the Circars. The leaves are said to give a kind of indigo, and Roxburgh warmly recommended its cultivation, but it does not seem that in the hundred years or more that have passed since his recommendations were made, much has been done in the matter, or even that the value of the dye has been commercially tested. *M. lucida*, Edgew.; Brandis For. Fl. 333; Vern. *Dudhi*, Kumaon, is a large evergreen climber of the Kumaon Himalaya and the forests of Oudh.

1. **M. Roylei**, Wight; Fl. Br. Ind. iv. 34; Brandis For. Fl. 333; Gamble Darj. List 56. Vern. *Pathor*, Chenab; *Tar*, *veri*, Salt Range; *Kurang*, Simla; *Kharchu*, Jaunsar; *Shengori*, Garhwal; *Murkila*, Kumaon.

A climbing shrub. *Wood* white, soft, porous. *Annual rings* marked by large pores, *pores* in the rest of the wood moderate-sized, scanty. *Medullary rays* inconspicuous.

Himalaya, from Sikkim westwards, up to 7000 ft., common in the West.

H 3194. Naldehra, Simla, 6000 ft. (Gamble).

2. **M. tenacissima**, W. and A.; Fl. Br. Ind. iv. 35; Brandis For. Fl. 333; Kurz For. Fl. ii. 201; Trimen, Fl. Ceyl. iii. 155. *Asclepias tenacissima*, Roxb. Fl. Ind. ii. 51. Vern. *Jiti*, *chiti*, *har chikkar*, Hind.; *Muruva-dul*, Cingh.

A climbing shrub. *Bark* ¼ in. thick, yellowish-grey, granular. *Wood* white, moderately hard. *Pores* small to large, scanty, in radial strings, the largest outermost. *Medullary rays* very inconspicuous, extremely fine, close and numerous.

Himalaya and sub-Himalayan tract from the Jumna to Nepal, extending south to Behar and Chota Nagpore; Chittagong and Upper Burma; dry region of Ceylon. It is most common in hedges, on waste places, and among shrubby growth.

This climber is remarkable for its strong silky fibre called "Rajmehal fibre," used by the Sonthals for bow-strings. Roxburgh says that a line of it broke with a weight of 248 lbs. when dry and 343 lbs. when wet, while common hemp only withstood 158 and 190 lbs. Royle says that a 1½-in. rope broke with 903 lbs., strong European

rope breaking with 1203 lbs. The cultivation has often been advocated, especially as it thrives on poor lands otherwise likely to be uncultivated.

	lbs.
O 4401. Bidhalna, Dehra Dún, 2000 ft. (Gamble)	37

9. PERGULARIA, Linn. Two species. *P. pallida*, W. and A.; Fl. Br. Ind. iv. 38; Brandis For. Fl. 334; Kurz For. Fl. ii. 203; Talbot Bomb. List 139 (*Asclepias pallida*, Roxb. Fl. Ind. ii. 48); Vern. *Surkila*, Kumaon, is a large climbing shrub of the Himalaya, Northern India and the Deccan. *P. minor*, Andr.; Fl. Br. Ind. iv. 38 (*P. odoratissima*, Wight; Brandis For. Fl. 334; Kurz For. Fl. ii. 203; Talbot Bomb. List 139); Vern. *Kanjalúta*, Beng., is the "West Coast" or "Primrose" creeper cultivated in Indian gardens and wild in the Himalaya as far west as Jaunsar.

10. DREGEA, E. Meyer.

1. **D. volubilis**, Benth.; Fl. Br. Ind. iv. 46; Talbot Bomb. List 140; Trimen Fl. Ceyl. iii. 161. *Asclepias volubilis*, Roxb. Fl. Ind. ii. 36. Vern. *Dori, ambri, herandori*, Mar.; *Kurincha*, Tam.; *Karigichi*, Badaga; *Kirianguna*, Cingh.

A large climbing shrub. *Bark* brown, rough, corky, fissured, inner bark white, ¼ in. thick. *Wood* white, soft. *Pores* small to large, often subdivided, arranged in somewhat oblique radial strings. *Medullary rays* very fine, very numerous.

Bengal, Assam; Western and Southern India, very common on the Nilgiris; low country of Ceylon, up to 3000 ft.

This climber is at once recognized by its large umbels of bright green flowers. The leaves are eaten in curries in Ceylon, and are used in medicine.

W 3774. Nilgiri Hills, 5000 ft. (Gamble).

11. LEPTADENIA, Br.

Two species. *L. Spartium*, Wight; Fl. Br. Ind. iv. 64; Vern. *Kip*, Sind, is a glabrous shrub of the sea-coast of Bombay, Sind and the Northern Punjab plains.

1. **L. reticulata**, W. and A.; Fl. Br. Ind. iv. 63; Talbot Bomb. List 141; Trimen Fl. Ceyl. iii. 164. Vern. *Khar-kodi*, Mar.

A climbing shrub. *Bark* yellowish-brown, very rough, thick. *Wood* fibrous, white. *Pores* large and very large, often subdivided, scanty, with many empty spaces arranged in a network. *Medullary rays* few, moderately broad.

Sub-Himalayan tract in Ambála and Dehra Dún; Bandelkhand; Deccan and Carnatic; dry country of Ceylon: chiefly in hedges.

D 4275. Khojjapalle, Anantapur (Gamble).
D 4166. Viziarayi, Ellore, Godavari „

12. ORTHANTHERA, Wight.

1. **O. viminea**, W. and A.; Fl. Br. Ind. iv. 64; Brandis For. Fl. 335. Vern. *Mowa, lanebár*, Trans-Indus; *Matti*, Beas; *Khip*, Delhi; *Kip*, Sind; *Chapkia*, Kumaon; *Mahúr*, Oudh.

A very twiggy erect shrub. *Bark* greyish-white, smooth. *Wood* white, soft, with faint light concentric bands. *Pores* small to moderate-sized, scanty. *Medullary rays* fine to moderately broad, fairly numerous.

Sind, the Punjab and sub-Himalayan tract as far as Oudh; in river-beds.

A conspicuous leafless plant of the "rau" beds of the Siwaliks and sub-Himalayan tract; useful in helping to check the torrents. The fibre is made into rope and the flower-buds are eaten.

O 4493. Motichúr Rau, Dehra Dún (Gamble).

D 4274 from Garladinne, Anantapur District, is the wood of *Sarcostemma brevistigma*, W. and A.; Fl. Br. Ind. iv. 26. A leafless, jointed, fleshy, climbing shrub. *Bark* thick, light brown, rough. *Wood* white, soft. *Pores* moderate-sized, scanty, often subdivided. *Medullary rays* very fine and indistinct.

ORDER LXXIV. **LOGANIACEÆ.**

Five Indian genera, belonging to two Tribes, viz.—

Tribe I. Euloganieæ	Buddleia, Fagræa, Strychnos.
„ II. Gaertnerieæ	Gaertnera, Gardneria.

Kurz has divided this Order among several neighbouring ones, placing *Strychnos* in APOCYNACEÆ, *Buddleia* in PEDALINEÆ, *Fagræa* in GENTIANACEÆ, *Gardneria* in SOLANACEÆ, but it is far preferable here to adopt the arrangement of the "Genera Plantarum" and "Fl. Br. Ind." At the same time, the genera which make up the Order do seem to differ considerably, and the same difference seems to extend to the wood-structure. Trimen considers the Order to be very closely allied to RUBIACEÆ, and one genus, *Gaertnera*, has the appearance and in almost all respects the structure of that Order.

Gelsemium elegans, Benth. is a Chinese climbing shrub, recently found in the Kachin Hills.

The characters of the woods differ so greatly that it is not possible to give general ones for the Order. *Strychnos* has scanty large pores (or ducts) and small pores in a network; *Fagræa* is somewhat similar, but the pores in the network are not distinguishable. *Buddleia* and *Gardneria* differ completely.

1. BUDDLEIA, Linn.

Wood soft or moderately hard, no heartwood. *Annual rings* distinctly marked by a belt of numerous pores, the *pores* in the outer wood being smaller and often arranged in groups or concentric lines. *Medullary rays* fine.

1. B. Colvillei, Hook. f. and Th.; Fl. Br. Ind. iv. 81; Gamble Darj. List 57. Vern. *Puri singbatti*, Nep.; *Pya-shing*, Bhutia.

A small tree. *Bark* grey, corky-papery, longitudinally cleft. *Wood* reddish-brown, soft. *Pores* of two sizes: large near the annual rings, smaller in the autumn wood, these latter grouped, the groups being enclosed in patches of soft tissue, which are arranged in interrupted concentric bands. *Medullary rays* fine.

Sikkim Himalaya at 9-12,000 ft.

Growth slow, 13 rings per inch of radius. An extremely handsome tree with masses of dark crimson flowers, which appear in August and make the tree very conspicuous in its habitat on the summit of Mount Tonglo. It is beautifully figured in Hook. f. Ill. Him. Pl. t. 18.

	lbs.
E 2393. Tonglo, Darjeeling, 10,000 ft. (Gamble)	35

2. B. macrostachya, Benth.; Fl. Br. Ind. iv. 81; Gamble Darj. List 57. Vern. *Pejunpati*, Nep.

A shrub with rusty pubescent leaves. *Bark* light brown, fibrous, peeling off in long fragile strips. *Wood* moderately hard, yellowish-white. *Pores* small, in groups of loose tissue, the groups in rough concentric bands. *Medullary rays* fine, not very numerous. *Annual rings* marked by a belt of pores.

Sikkim Himalaya, at 6-7000 ft.; Khasia and Naga Hills.
Khasia Hills—Kew Museum (J. D. Hooker).

3. **B. paniculata,** Wall.; Fl. Br. Ind. iv. 81; Brandis For. Fl. 318; Kurz For. Fl. ii. 251. Vern. *Spera wuna,* Afg.; *Prind,* Sutlej; *Dholtu, ghúttia, sodhera, sudhari,* N.-W. Him.; *Sinna,* Nep.

A large evergreen shrub. *Bark* thin, light grey, peeling off in long strips. *Wood* white, moderately hard, close-grained. *Annual rings* marked by a belt of small pores. *Pores* in the autumn wood very small, in groups and in oblique lines. *Medullary rays* fine.

Baluchistan; Himalaya, from the Indus to Bhutan, at 4-7000 ft.; Upper Burma.

A handsome shrub with white woolly or tawny leaves and lilac flowers, but often very stunted. It is found on dry slopes and among rocks. Growth moderate, 11 rings per inch of radius.

		lbs.
H 158.	Simla, 7000 ft.	41
H 2882.	Nagkanda, Simla, 7000 ft. (Gamble)	—

4. **B. asiatica,** Lour.; Fl. Br. Ind. iv. 82; Bedd. Fl. Sylv. clxiii.; Brandis For. Fl. 318; Kurz For. Fl. ii. 250; Gamble Darj. List 56; Talbot Bomb. List 142. *B. Neemda,* Roxb. Fl. Ind. i. 396. Vern. *Bhati, dhaula, shiúntra,* Kumaon; *Bana,* Simla; *Newarpati,* Nep.; *Pondám,* Lepcha; *Nimda, budhbola,* Chittagong; *Kyaung-migu,* Burm.

A large evergreen shrub. *Bark* thin, grey. *Wood* grey, moderately hard. *Annual rings* distinctly marked by a belt of closely-packed pores in the spring wood. *Pores* small, not all of equal size, scanty except along the annual rings. *Medullary rays* fine, numerous.

Sub-Himalayan tract from the Indus eastwards, ascending to 4000 ft.; Bengal, Burma, South India; often cultivated in gardens.

This ornamental shrub has long spikes of white fragrant flowers, with white tomentose leaves. It is chiefly found in second-growth forests, on roadsides, in grass savannahs, on deserted village sites; in the Lower Himalaya and Siwaliks it comes up profusely on landslips; in Western and Southern India it occurs in ravines and on river-banks. Growth fast, 4½ rings per inch of radius.

		lbs.
H 110.	Sutlej Valley, Simla, 4000 ft.	44

2. FAGRÆA, Thunb.

Seven species, trees or shrubs, sometimes epiphytes. *F. zeylanica,* Thunb.; Fl. Br. Ind. iv. 83; Bedd. Fl. Sylv. clxiv.; Fl. Ceyl. iii. 170; Vern. *Etamburu,* Cingh., is a small tree of the low country of Ceylon up to 2000 ft., chiefly in the moist region; also (var. *brevituba*) of South India. In Ceylon the flowers are more than 3 in. long. *F. carnosa,* Jack; Kurz For. Fl. i. 204, is an epiphytic shrub, and *F. auriculata,* Jack (*F. auricularia,* Benth.; Kurz For. Fl. ii. 204), an erect shrub, of Tenasserim. *F. khasiana,* Benth.; Fl. Br. Ind. iv. 84, is a tree of Assam and the Khasia Hills up to 5000 ft.

Wood hard, close-grained, grey or light brown. *Pores* large, scanty, often subdivided. *Medullary rays* fine, very numerous. Concentric pale bands numerous: in these there may be (extremely fine) pores as in *Strychnos,* but I cannot detect them.

1. **F. obovata,** Wall; Fl. Br. Ind. iv. 83; Bedd. Fl. Sylv. clxiv.; Kurz For. Fl. ii. 205; Gamble Darj. List 57; Talbot Bomb. List 142; Trimen Fl. Ceyl. iii. 171. *F. coromandelina,* Wight; Bedd. Fl. Sylv. t. 244. Vern. *Ginnuna,* Kan.; *Suna khari,* Nep.; *Longsoma,* Magh; *Thagyalatwa,* Burm.

A small or moderate-sized tree, sometimes epiphytic. *Bark* grey, smooth. *Wood* grey, soft. *Pores* moderate-sized, scanty, in pairs or

threes; with occasional regularly spaced very large pores (or intercellular ducts) filled with resinous matter. *Medullary rays* fine.

Eastern Himalaya, especially in the Bhutan Hills; Khasia Hills up to 4000 ft.; Chittagong Hill tracts and the mixed forests of Burma; forests of the Kumta taluka of N. Kanara and thence along the Western Ghâts, frequent and conspicuous in the Nilgiris; lower hills of Ceylon.

W 4176. Naduvatam, Nilgiris, 6000 ft. (Gamble).

No. E 1450 (56 lbs. per cubic foot), brought by Griffith from the Mishmi Hills in 1836, is probably this species.

2. **F. racemosa**, Jack; Fl. Br. Ind. iv. 84; Kurz For. Fl. ii. 205. Vern. *Thit-hpalu*, Burm.

A moderate-sized, evergreen tree. *Wood* moderately hard, greasy to the touch and with a scent like that of indiarubber. *Pores* moderate-sized, scattered, often oval and subdivided. Narrow, wavy, concentric pale bands, alternating with broader bands of firmer tissue, in which the fine, numerous *medullary rays* are distinctly visible.

Andaman Islands.

The Fl. Br. Ind. quotes Kurz For. Fl. under *F. racemosa*, but does not give the Andamans for a habitat. It seems most probable that the woods belong to *F. morindæfolia*, Bl., which at any rate is very near to the Malayan *F. racemosa*, but the Fl. Br. Ind. says *F. morindæfolia* is only a rambling shrub, while the specimens clearly belong to a tree. Weight 50 lbs. per cubic foot. Colonel Ford says that the wood is strong and durable, that it is used for house-posts, and the root bark as a cure for fever.

		lbs.
B 1990.	Andamans (Kurz, 1866)	52
B 2294.	„ (Col. Ford, 1866)	48

3. **F. fragrans**, Roxb. Fl. Ind. i. 461; Fl. Br. Ind. iv. 85; Kurz For. Fl. ii. 205. Vern. *Anan*, Burm.

An evergreen tree. *Wood* light brown, hard, close-grained. *Pores* (or intercellular ducts) large, very scanty, often subdivided and filled with a white substance. Numerous pale concentric bands alternating with about equal bands of firmer tissue in which the fine numerous *medullary rays* are distinctly visible. On a vertical section the wood shows a mass of short fine vertical lines, which apparently are the medullary rays, which are consequently not deep.

Eng forests of Martaban and Tenasserim, very common, especially round the Heinze basin.

One of the most important of the second-class trees of Burma. The wood is used for house-building, bridge and wharf piles, boat-anchors and other purposes; it has been recommended for joinery. It has recently been the subject of experiment and report ("Ind. Forester," vol. xxv. 440), from which it seems that about 200,000 tons of the wood are available from the Tenasserim Division, in logs up to 60 ft. in length. The durability of the wood is attested by bridge-posts at Myohaung, Tavoy, said to be over 200 years old; by similar bridge-posts at Onbinkwin and in Kyousat chaung; and by posts in the moat of the old city of Tenasserim, 300 years old. The results of the experiments were that the average weight per cubic foot is 60 lbs., and P comes to about 980. The Report says that the Municipality (of Rangoon?) is testing its use for wood-paving.

Crushing weight: two specimens 4″ × 1″ × 1″ required 9744, 8624 lbs. against 12,000 as given by Molesworth for Teak and 8200 for English Oak.

According to Baker, W = 70 lbs. and his experiments with Tavoy wood in bars 7′ × 2″ × 2″ gave P = 553; Wallich gives W = 52½ lbs.; Simpson gives W = 57 lbs. and P = 387, but the specimen was not good; Seaton gives 60 lbs. It is probable

that W may best be taken at 60 lbs., and that Baker's value of P. obtained from the trial of large pieces of wood is the most accurate. The most important quality of the wood is clearly its power of resisting teredo and its great durability both in fresh and salt water.

H. C. Hill, in his Reports (1900) on Forest Conservancy in the Straits Settlements, and the Federated Malay States, mentions that this tree (Vern. *Tembusu*) is very largely gregarious, coming up freely on grassy blanks in the forest, and easily propagated artificially. He recommends it as a nurse for gutta-percha.

		lbs.
B 289.	Burma (1867)	53
B 550.	Martaban (Seaton)	65
B 3073.	Burma (Brandis, 1862, No. 120)	57

3. STRYCHNOS, Linn.

Sixteen species, of which all but two are more or less climbing shrubs. Among these climbing shrubs only two or three are at all common. *S. colubrina*, Linn.; Fl. Br. Ind. iv. 87; Talbot Bomb. List 142; Trimen Fl. Ceyl. iii. 173; Vern. *Kanal, kajer bel*, Mar., is a large species of the Western Ghâts and the drier regions of Ceylon. *S. cinnamomifolia*, Thw.; Fl. Br. Ind. iv. 89; Trimen Fl. Ceyl. iii. 174; Vern. *Etakirindiwel, wel-beli*, Cingh., is a very large climber endemic in the moist low country of Ceylon. *S. Rheedii*, Clarke; Fl. Br. Ind. iv. 87, is said by Bourdillon to be an enormous climber of the evergreen forests of Travancore, up to 3000 ft. *S. Wallichiana*, Benth.; Fl. Br. Ind. iv. 90, is a climbing shrub ("a tree" according to Kurz For. Fl. ii. 167, which is not, however, quoted in Fl. Br. Ind.) of Assam and Sylhet.

The structure of *Strychnos* is curious and demands further study. In some of the S. American and S. African species (see Nordlinger's Sections) what are here called large pores with white contents seem to be fibro-vascular bundles like those of Monocotyledons scattered in the wood in addition to the pores and medullary rays as usual. In the two species here given, the large pores seem to be single and not compound.

1. **S. Nux-vomica,** Linn.; Fl. Br. Ind. iv. 90; Roxb. Fl. Ind. i. 575; Bedd. Fl. Sylv. t. 243; Brandis For. Fl. 317; Kurz For. Fl. ii. 166; Talbot Bomb. List 142; Trimen Fl. Ceyl. iii. 175. The Snake Wood, Nux-vomica or Strychnine tree. Vern. *Kuchla, kajra*, Hind.; *Kuchila*, Beng.; *Kerra, korra, kuchila*, Uriya; *Mushti*, Koya; *Mushidi*, Reddi; *Yetti, eddi, kanchurai*, Tam.; *Mushti, musadi*, Tel.; *Kasaraka, kajarra, khasca, kasaragadde, kasarkana*, Kan.; *Kara, jhar katchura, kajra*, Mar.; *Kanjiram*, Mal.; *Goda kadúru*, Cingh.; *Kabaung*, Burm.

A moderate-sized or large deciduous tree. *Bark* thin, dark grey, or yellowish-grey, smooth. *Wood* white when fresh cut, turning yellowish-grey on exposure, hard, close-grained, durable. No heartwood, no annual rings. *Pores* of two classes: large pores very scanty; very small pores numerous, in irregular ramified patches, which are joined by concentric and oblique white lines, the general pattern fantastic on a cross-section. *Medullary rays* white, fine and moderately broad, numerous, sharply defined in the darker tissue. The large pores, which are prominent as white streaks on a vertical section, are filled with a white pith-tissue, and sometimes ramify; they may be not vessels, but large intercellular ducts.

Gorakhpur forests in Northern India; Bengal, Orissa, the Circars; the Deccan and Carnatic; moist forests in the Bombay Presidency; deciduous forests all over Burma; dry region of Ceylon.

A common and important tree in South India, almost all parts, leaves, bark, fruit and especially the seeds, being poisonous, and the latter yielding the alkaloids Strychnine and Brucine, so that there is a considerable trade in them. The fruit is a large orange-coloured berry, and the seeds are round, flat, coin-like and silvery in colour.

For the market it is best that the seeds should be "bright," that is clean and silvery, so that it is necessary that they should be washed out of the fruit and not merely picked up under the tree. Seeds picked up are usually dull in colour, muddy and (whether or not they contain as much alkaloid) of very second-rate market quality. In the Striharikota forests of Nellore, where the tree is common, the seeds are washed out by a forest tribe, the Yanadis, and a good price is usually obtained for them. The London market quotation is usually about 7 to 10 shillings per cwt. The exports are chiefly from Madras, Bombay and Cochin, and are of considerable amount. The seeds also give a dye and a medicinal oil. The pulp of the fruit, though containing also some poison, is eaten by the Langúr monkeys (*Semnopithecus entellus*, Blyth and *S. priamus*, And.) and also by the Malabar pied hornbill (*Anthracoceros coronatus*, Elliot) and perhaps by other hornbills, parrots and other birds, but the seeds are probably always rejected or else pass undigested. But while the Langúr monkeys can apparently eat the fruit and even seeds without harm, other monkeys as well as other animals and man cannot do so, though it is said that the flying fox can eat the pulp with impunity. The Strychnine tree is handsome, and when in flower is at once recognizable by the strong odour of turmeric which the flower gives off. The shoots when very young may occasionally be browsed by goats, otherwise the tree is untouched by animals.

The wood is bitter and is not eaten by white ants, but it is not much used. Brandis makes no mention of any use, nor does Trimen; Beddome and Kurz say it is used for plough-shares, cart-wheels, cots and fancy cabinet-work. Skinner, No. 119, gives W = 56 lbs. and P = 1160; Brandis' three experiments of 1864 with Burma wood in bars 3′ × 1″ × 1″ gave W = 49 lbs., P = 623, while his list of 1862, No. 75, gave W = 52 lbs.; the average of the specimens examined gives 59 lbs., so that we may take the average of 54 lbs. as the weight per cubic foot.

Reproduction is apparently good, and artificial cultivation should be easy, but the sylviculture still requires investigation. Brandis calls this and *S. potatorum* "evergreen," but Kurz calls them both "deciduous." My own experience agrees with Kurz' views.

		lbs.
C 3537, 3538.	Khurdha Forests, Orissa (Gamble)	63 and 54
D 4005.	Cuddapah Forests (Higgens)	59
D 4028.	Collegal Forests, Coimbatore	61
W 1224.	North Kanara (Barrett)	65
W 727.	South Kanara (Cherry)	59
B 3072.	Burma (Brandis, 1862)	49

1. S. potatorum, Linn. f.; Fl. Br. Ind. iv. 90; Roxb. Fl. Ind. i. 576; Bedd. Fl. Sylv. clxiii.; Brandis For. Fl. 317; Kurz For. Fl. ii. 167; Talbot Bomb. List 143; Trimen Fl. Ceyl. iii. 176. The Clearing Nut tree. Vern. *Nirmali, nel mal*, Hind.; *Kotaku*, Uriya; *Ustumri*, Gondi; *Tettancottai, tettian, tetta*, Tam.; *Chilla, indupa, induga, katakamu, judapa*, Tel.; *Nirmali, chilbinj*, Mar.; *Tettam-parel*, Mal.; *Chillu*, Kan.; *Induva*, Koya; *Chidla*, Reddi; *Ingini*, Cingh.

A moderate-sized deciduous tree. *Bark* ½ to ¾ in. thick, black or brownish-black, corky, very deeply and narrowly cleft vertically, so as to form thin ridges which easily break off. *Wood* white when fresh cut, turning yellowish-grey on exposure, hard, close-grained, seasons well. No heartwood, no annual rings. *Pores* of two classes: large pores very scanty; very small pores numerous, arranged in irregularly ramified patches, which are extremely variable in shape, giving the wood a remarkably fantastic pattern on a cross-section, as in *S. Nux-vomica*. These patches are joined by white concentric lines which may possibly represent annual rings. *Medullary rays* white, fine and moderately broad, numerous, sharply defined in the darker tissue. The large pores, which are prominent on a radial section, are filled with a white shining pith-tissue and are often ramified; they are probably not vessels, but large intercellular ducts.

Deciduous forests in the Peninsula of India: the Central Provinces; Orissa and the Circars; the Deccan, Carnatic and Southern Mahratta country; the drier forests in

Travancore; open and dry forests of the Prome District in Burma; dry country of Ceylon.

Unlike the previous species, the Clearing Nut tree is not poisonous, but, on the contrary, its seeds are used to clear muddy water, which is done by rubbing the inside of the vessels with them. It is not definitely fully known how this action takes place, but Dr. Cornish, quoted by Watt, says "the construction of the nut is clearly vegetable 'albumen, and this, when rubbed down with water, acts mechanically as a precipitant 'of suspended matter." They are also used in medicine, and the pulp of the fruit is eaten and made into preserve. The wood is good. Beddome says it is "much in use 'for ploughs, building purposes, cart-wheels, etc.," and Kurz says much the same. The weight per cubic foot is about 58 lbs.

		lbs.
C 2979.	Bijeragogarh, C.P.	—
C 1101.	Ahiri Reserve, C.P. (R. Thompson)	55
C 4463.	Chanda Forests, C.P. (Lowrie)	—
C 3500.	Khurdha Forests, Orissa (Gamble)	—
D 4235.	Nallamalai Hills, Kurnool (Gamble)	58
D 4007.	Cuddapah Forests (Higgens)	50
D 1060.	South Arcot (Beddome)	61
No. 44, Salem Collection		56

4. GAERTNERA, Lamk. Four species, Ceylon shrubs, three of which are endemic. The genus very closely resembles *Psychotria* (Rubiaceæ), but is distinguished by the superior ovary. *G. Königii*, Wight; Fl. Br. Ind. iv. 91; Bedd. Fl. Sylv. clxiv.; Trimen Fl. Ceyl. iii. 177; Vern. *Péra-tambala*, Cingh., is a large shrub, common in the moist low country of Ceylon up to 3000 ft.

5. GARDNERIA, Wall.

Two species, climbing shrubs. *G. angustifolia*, Wall.; Fl. Br. Ind. iv. 93; Gamble Darj. List 57; Vern. *Takpadik*, Lepcha, is found in the Himalaya from Chakrata and Mussoorie to Bhutan, at 5–8000 ft., usually in ravines like the "Beargarden" at Chakrata and the "Mossy falls" at Mussoorie.

1. **G. ovata**, Wall.; Fl. Br. Ind. iv. 93; Kurz For. Fl. ii. 227.

A large climber, with spirally twisting stem. *Bark* dark brown, rough, ¼ in. thick. *Wood* made up of narrow indented wedges which radiate star-like but increase in width from the centre outwards and are separated by fibrous bast tissue. *Pores* moderate-sized to large, often subdivided, arranged in somewhat concentric lines separated by concentric lines of pale loose tissue. *Medullary rays* extremely fine, very numerous.

Khasia Hills; Nilgiri Hills at 5–7000 ft., common.

W 3797. Fairlawns, Ootacamund, 7000 ft. (Gamble).

ORDER LXXV. BORAGINEÆ.

Four Indian woody genera belonging to three Tribes, viz.—

Tribe I.	Cordieæ	Cordia.
„ II.	Ehretieæ	Ehretia, Rhabdia.
„ III.	Heliotropieæ	Tournefortia.

Most of the plants belonging to the Order are herbaceous and several of them are showy garden plants, some shrubby. The Heliotrope, *Heliotropium peruvianum*, Linn., sometimes reaches the size of a shrub, especially on the Nilgiris, that home for foreign plants from all temperate regions of the world. Some of the species of *Cordia* have woods of pretty grain useful in carpentry.

There is no general character for the woods of this Order. *Cordia* has well-marked bands of soft tissue in most species and a dark brown, teak-like wood; *Ehretia* has an even-grained light-coloured wood with annual rings usually marked by larger pores.

1. CORDIA, Linn.

Thirteen species, fairly evenly distributed over the country, some of them having useful woods deserving of being better known and more in use, especially for furniture. *C. obliqua*, Willd.; Fl. Br. Ind. iv. 137 (*C. latifolia*, Roxb. Fl. Ind. i. 588, *C. Myxa*, Linn. (part); Brandis For. Fl. 336, *C. Wallichii*, G. Don; Bedd. Fl. Sylv. t. 245; Talbot Bomb. List 144); Vern. *Geduri*, Sind; *Sepistan, pistan*, Guj.; *Bara lesura*, Hind.; *Burgund, duhiwan*, Mar.; *Chandle*, Kan., is a tree of the Western Gháts, Guzerát and other dry parts of the Bombay Presidency, also Mysore, very nearly allied to *C. Myxa*, with which Brandis unites it, keeping *C. Wallichii* separate. *C. monoica*, Roxb. Fl. Ind. i. 592; Fl. Br. Ind. iv. 137; Bedd. Fl. Sylv. clxvi.; Talbot Bomb. List 144; Trimen Fl. Ceyl. iii. 193 (*C. polygama*, Roxb. Fl. Ind. i. 594; Bedd. Fl. Sylv. clxvi.; Kurz For. Fl. ii. 207); Vern. *Pida*, Hind.; *Panugeri*, Tel.; *Naruvili*, Tam., is a small irregular tree of Orissa, the Circars, Deccan, West and South India and Ceylon. *C. grandis*, Roxb. Fl. Ind. i. 593; Fl. Br. Ind. iv. 137; Kurz For. Fl. ii. 208; Gamble Darj. List 57; Vern. *Asari*, Nep.; *Thanat*, Burm., is a large tree of the Sikkim Terai and lower hills, Assam, Chittagong and Burma, with a pale brown, light wood, and large leaves which are used to make the outer wrapping of Burmese native cigars. *C. Perrottetii*, Wight and *C. fulvosa*, Wight are small trees of the South Deccan in dry forests. *C. oblongifolia*, Thw.; Trimen Fl. Ceyl. iii. 194, is a straggling shrub endemic in Ceylon. *C. subcordata*, Lamk.; Fl. Br. Ind. iv. 140; Kurz For. Fl. ii. 209; Trimen Fl. Ceyl. iii. 195 (*C. campanulata*, Roxb. Fl. Ind. i. 593), is a handsome large shrub of the Coast forests of the Andamans, Tenasserim and Ceylon, with orange-yellow flowers. *C. speciosa*, Willd. and *C. tectonifolia*, Wall. are small red-flowered trees introduced from the West Indies and often cultivated in Indian gardens. The "*Inderab*" tree of the Soudan is *Cordia abyssinica*, Br. It gives a good timber, easily converted and suitable for most purposes (Muriel).

Pores of variable size, more or less joined by concentric, often broken, belts of loose tissue, separated by darker belts in which the medullary rays are prominent. *C. Myxa* and *C. octandra* have soft woods, the others have hard woods much resembling good Teak, durable and suitable for carpentry.

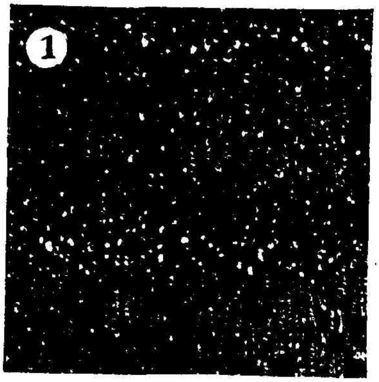
1. **C. Myxa**, Linn.; Fl. Br. Ind. iv. 136; Roxb. Fl. Ind. i. 590; Bedd. Fl. Sylv. clxv.; Brandis For. Fl. 336; Kurz For. Fl. ii. 208; Gamble Darj. List 57; Talbot Bomb. List 144; Trimen Fl. Ceyl. iii. 193. Vern. *Lasora, bhokar, gondi*, Hind.; *Laswara*, Pb.; *Lesúri, gidúri*, Sind; *Katula, lasora*, Garhwal; *Borla, baurala, borilu, lisáro*, Kumaon; *Bohari, buhal*, Beng.; *Boeri*, Nep.; *Nimat*, Lepcha; *Dobakari*, Mechi; *Gondi, ambata*, Uriya; *Baragund, lasora*, Merwara; *Gunda*, Jeypore; *Gondhan*, Berar; *Vidi, verasu, naruvili*, Tam.; *Pedda boku, virgi, nakkera, irki, iriki*, Tel.; *Bholiya, pajipotong*, Khond; *Embrúm*, Kól; *Semar, goden, gondan, shelu, bhokur, vargund*, Mar.; *Chotte, chella*, Kan.; *Virasham*, Mal.; *Karadi*, Trav. Hills; *Selte*, Gondi; *Silu, chilu*, Kurku; *Lasséri*, Baigas; *Lolú*, Cingh.; *Chaine*, Magh; *Thanat, taung thanat*, Burm.

A moderate-sized deciduous tree. *Bark* ½ to ¾ in. thick, grey or brown, rough with shallow longitudinal wrinkles and furrows. *Wood* greyish-brown, moderately hard. *Pores* moderate-sized or large, scanty, scattered and frequently double, or partitioned, joined by concentric bands of tissue which consist of large rectangular or six-angled wood cells; the alternate bands denser and closer in texture. *Medullary rays* short, moderately broad, shallow, prominent on a radial section as a mottled silver-grain.

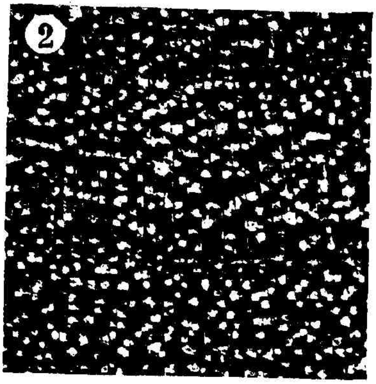
Throughout India, Burma and Ceylon, extending to the Punjab Himalaya, and rising to 5000 ft.; often planted.

A crooked tree of rather uninteresting character, but pretty when in flower or fruit. Growth moderately fast, 8 to 9 rings per inch of radius (Brandis); specimens here given do not show the rings well, with the exception of two, which give 1 to 2 rings per inch,

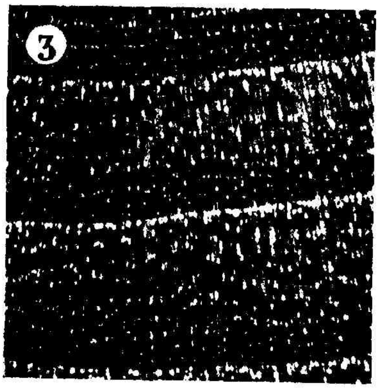
XI.



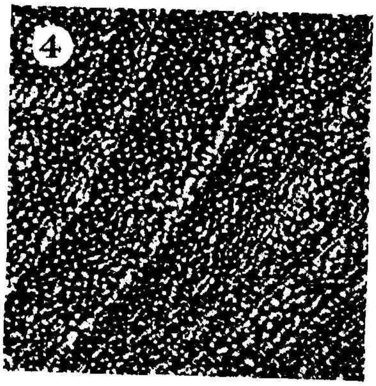
CORDIA MYXA.



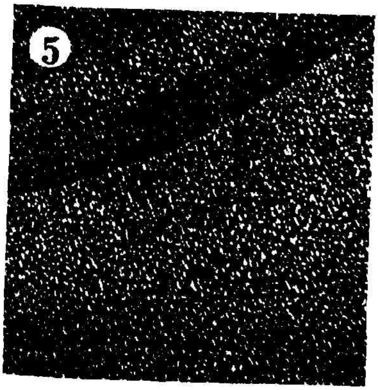
CORDIA FRAGRANTISSIMA.



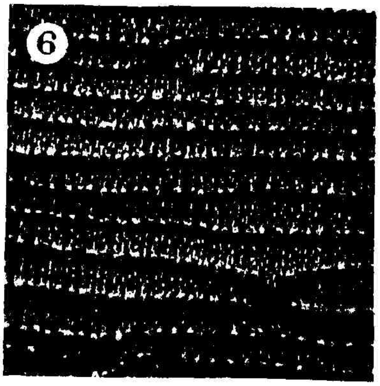
EHRETIA ACUMINATA.



HETEROPHRAGMA ADENOPHYLLUM



PREMNA PYRAMIDATA.



AVICENNIA OFFICINALIS.

(*Magnified* $3\frac{1}{2}$ *times.*)

which must be called very fast. The weight is very variable. Brandis in Burma List of 1862, No. 82, gives 33 lbs. per cubic foot; specimens enumerated below vary from 23 to 42 lbs., but the average is 33 lbs. Brandis in For. Fl., p. 337, says 33 to 49 lbs. The wood, in spite of its softness, is fairly strong, and seasons well, but is readily attacked by insects. It is used for boat-building, well-curbs, gun-stocks and agricultural implements (Brandis), in Bengal for canoes. It might be tried for tea-boxes. It is an excellent fuel. The bark is made into ropes and the fibre is used for caulking boats. The leaves are used as plates and in Pegu to cover Burmese cheroots. The fruit (*Sebestan*) is eaten; it is very mucilaginous, and is used in native medicine. The viscid pulp is used as birdlime and for marking linen, but the mark is fugacious. The kernel is eaten.

		lbs.
O 250.	Garhwal (1868)	42
O 1376.	Gonda, Oudh (Wood)	38
C 1149.	Ahiri Reserve, Central Provinces (R. Thompson)	37
E 642.	Rakti Forest, Darjeeling Terai (Manson)	28
E 2394.	Bamunpokri, Darjeeling Terai (Gamble)	28
E 714.	Chittagong (Chester)	23
B 2543.	Burma (Brandis, 1862)	36
No. 42, Salem Collection (marked *Spondias mangifera*)		32
Nordlinger's Sections, vol. 10 (Tab. XI. 1).		

Nos. B 5022 (Tharrawaddy), B 5040 (Pegu), B 5046 (Bassein), Burma, received as *Cordia grandis*, appear to belong to *C. Myxa*, with which they agree in structure.

2. C. **Rothii**, Röm. and Sch.; Fl. Br. Ind. iv. 138; Brandis For. Fl. 338; Bedd. Fl. Sylv. clxvi.; Talbot Bomb. List 144; Trimen Fl. Ceyl. iii. 194. *C. angustifolia*, Roxb. Fl. Ind. i. 595. Vern. *Gondi, gondni, gundi*, Hind.; *Liár, liái*, Sind; *Narvilli*, Tam.

A small tree. *Bark* grey or brownish-grey, with deep longitudinal furrows. *Wood* compact, hard: sapwood yellowish; heartwood brown, streaked in different shades. *Pores* small to moderate-sized, joined by concentric bands of loose texture of varying width and sometimes anastomozing. *Medullary rays* fine and moderate-sized, prominent in the dark hard tissue between the concentric belts above referred to.

Dry region of India: Ajmere, the Bombay Presidency, Mysore and South Deccan; dry region of Ceylon; planted and self-sown in the Punjab, Sind, Rajputana and the N.-W. Provinces.

Growth moderate, 10 rings per inch of radius. Weight 42 to 52 lbs. per cubic foot (Brandis); specimens examined give 48 lbs. The wood is a fine one and deserves to be better known, and the tree to be more propagated. The wood is used for fuel, in Sind for building, and in Cutch for agricultural implements. The bark when wounded gives a gum, and the liber is made into ropes. The pulp of the fruit is eaten.

		lbs.
P 449.	Ajmere	46
P 4906.	Ajmere (Lowrie)	50

3. C. **fragrantissima**, Kurz For. Fl. ii. 207; Fl. Br. Ind. iv. 139. Vern. *Sandawa*, Burm.

A deciduous tree. *Wood* moderately hard, reddish-brown with darker streaks, beautifully mottled, has a fragrant scent. *Pores* moderate-sized to large, in roundish patches, which are joined by occasional, broken, concentric lines. *Medullary rays* rather distant, moderately broad, with a well-marked and rather handsome silver-grain.

Burma, chiefly in the hills of Martaban and Tenasserim, and in Upper Burma.

This species has a beautiful wood which should be better known. It has a handsome grain, and its fresh, fragrant odour makes it very pleasant to use. Pieces sent to London for sale in 1878 realized £4 10s. per ton of 50 cub. ft.

			lbs.
B	274.	Burma (1867)	48
B	1428.	Tharrawaddy, Burma	51

Nordlinger's Sections, vol. 10 (Tab. XI. 2).

4. **C. vestita,** Hook. f. and Th.; Fl. Br. Ind. iv. 139; Brandis For. Fl. 338. Vern. *Kúmbi, karúk*, Pb.; *Kúm paimán, pín, indak, chinta, ajánta, bairula, berula*, Hind.; *Bairolá*, Dehra Dún; *Latora*, Oudh.

A small deciduous tree. *Bark* ½ in. thick, dark grey, exfoliating when old in large woody scales. The wood has the same structure and appearance as that of *C. Rothii* and *C. Macleodii*, except that the concentric lines are more often interrupted.

Sub-Himalayan tract, from the Jhelum to the Sarda River, Oudh; fairly common in the Saharanpur Siwaliks.

A rather conspicuous but not very common tree, with large tomentose leaves and characteristic bark. The wood is of excellent quality and deserves to be better known as it is capable of making good furniture with a figured grain, not unlike good quality slow-grown Teak. It is strong and said to be used for wheel and well-work (Brandis). The fruit is eaten; it is preferred to that of *C. Myxa*.

			lbs.
O	231.	Garhwal (1868)	52
O	2998.	„ (1874)	53
O	3232.	Dehra Dún	—

5. **C. Macleodii,** Hook. f. and Th.; Fl. Br. Ind. iv. 139; Brandis For. Fl. 337, t. 41; Talbot Bomb. List 144. Vern. *Dhengan, dháman, dháian, dewan, dahi, dahipalas, dihgan*, Hind.; *Dhaiwan*, Sattara; *Daiwas, dhaim, bhoti*, Mar.; *Bot*, Gondi; *Lauri kassamár*, Kurku; *Gadru*, Ajmere; *Pedda battava*, Tel.; *Baurlo*, Uriya; *Godela*, Merwara; *Gadda*, Jeypore; *Renta, porponda*, Kól; *Bharwar, belaunan*, Kharwar; *Jugia*, Sonthal; *Borla mehranu*, Khond.

A middling-sized deciduous tree. *Bark* thick, grey, soft, corky. Heartwood light brown, beautifully mottled with darker veins, even-grained, very hard. *Pores* small to moderate-sized, in irregular concentric belts of light tissue, often joined by white lines without pores. *Medullary rays* white, fine and moderately broad, prominent.

Central India, in the Central Provinces, Chota Nagpore, Orissa, the Circars, Deccan; Konkan and North Kanara, in deciduous forest.

Weight 40 to 50 lbs. (Brandis); specimens examined give an average of 52 lbs. The wood is used for furniture, picture-frames and other ornamental work; also for fishing-rods, which are said to be excellent (Brandis). It deserves to be better known and more in use, and to be respected in sylvicultural operations. It is much esteemed by the natives in the Central Provinces, who use it for furniture and agricultural tools (Chicago Exh. Cat., 1893).

			lbs.
P	3219.	Nagpahar, Ajmere	—
C	180.	Mandla, Central Provinces (1870)	53
C	2985.	Jubbulpore (1863)	50
C	831.	Bairagarh Reserve, Berar (Drysdale)	49
C	3455.	Betlah Reserve, Palamow (Gamble)	—
D	3965.	Ballipalle Forests, Cuddapah (Higgens)	56

6. **C. octandra,** A. DC; Fl. Br. Ind. iv. 140; Bedd. Fl. Sylv. clxvi. *C. serrata*, Roxb. Fl. Ind. i. 592.

A small tree. *Wood* light brown, the colour of young teak, soft. *Pores* very small, very scanty, in narrow concentric belts of pale loose tissue. *Medullary rays* variable, some broad, some fine, as in *C. Myxa*.

Travancore.

lbs.

2. EHRETIA, Linn.

Ten species. *E. macrophylla*, Wall.; Fl. Br. Ind. iv. 141, is a tree of Nepal. *E. retusa*, Wall. and *E. parallela*, Clarke; Fl. Br. Ind. iv. 143, are trees of Burma. *E. ovalifolia*, Wight; Fl. Br. Ind. iv. 143; Bedd. Fl. Sylv. clxvii., is a small tree of the districts of Coimbatore, Madura and Tinnevelly up to 2000 ft.; while *E. Wightiana*, Wall.; Fl. Br. Ind. iv. 143; Bedd. Fl. Sylv. clxvii., is a small tree of the Tinnevelly Ghâts, common also up to 2000 ft. *E. buxifolia*, Roxb. Fl. Ind. i. 598; Fl. Br. Ind. iv. 144; Bedd. Fl. Sylv. clxvii.; Talbot Bomb. List 145; Trimen Fl. Ceyl. iii. 196; Vern. *Bapanabúri*, Tel., is a small bush of the dry scrub forests of the Circars, Deccan and Carnatic, very common and often cultivated as a garden shrub.

Wood very light brownish- or yellowish-white, moderately hard, even-grained, usually rough. *Pores* small, in radial lines or scattered, in some species larger in the spring wood where they mark the annual rings. *Medullary rays* fine to moderately broad, regular.

1. **E. acuminata**, Br.; Fl. Br. Ind. iv. 141. *E. serrata*, Roxb. Fl. Ind. i. 596; Brandis For. Fl. 339; Kurz For. Fl. ii. 210; Gamble Darj. List 57. Vern. *Puran, punna, kalthánu*, Punjab; *Púnyan, púnjlawái, panden, koda*, Hind.; *Kurkúria, arjún*, Oudh; *Narra, punya*, Garhwal; *Pandáyan*, Dehra Dún; *Shaursi*, Kumaon; *Nalshuna, chillay*, Nep.; *Bual*, Ass.; *Kala-aja*, Beng.

A moderate-sized tree. *Bark* grey or whitish-grey, ¼ in. thick. *Wood* very light brown, rough, moderately hard, resembling that of the ash. *Pores* of two kinds: those in the spring wood large and closely packed in a line, making conspicuous annual rings; those in the rest of the wood small, scattered. *Medullary rays* short, moderately broad, not numerous, giving a good silver-grain on a radial section.

Sub-Himalayan tract from the Indus to Bhutan, and along river valleys in the hills, ascending to 5000 ft.; Eastern Bengal, Chittagong and Upper Burma.

A conspicuous and handsome tree in the valleys of the Western Himalaya, common on the Upper Tons. The wood is good, and, according to Brandis, is made into scabbards, sword-hilts, gun-stocks, and used for building and for agricultural implements. Aikin in Wallich's List of 1831 gives 3·3 rings per inch of radius, the specimen examined gives 7 rings. Kyd gives W = 37 lbs. and P = 530, the specimen gives 44½ lbs. The unripe fruit is pickled and the ripe fruit eaten. The leaves are often affected by an orange-coloured fungus, *Uredo Ehretiæ*, Barclay (Ind. For. xviii. 21 and xxv. 436), suspected of being identical with *Puccinia dispersa*, Eriks. and Henn., the "brown rust" which attacks cereals.

	lbs.
H 4705. Upper Tons Valley, N.-W. Himalaya, 3500 ft. (Gamble)	44
Nordlinger's Sections, vol. 3 (Tab. XI. 3).	

2. **E. lævis**, Roxb. Fl. Ind. i. 597; Fl. Br. Ind. iv. 141; Bedd. Fl. Sylv. t. 246; Brandis For. Fl. 340, t. 42; Kurz For. Fl. ii. 210; Talbot Bomb. List 144; Trimen Fl. Ceyl. iii. 195. Vern. *Chamrór, kóda, darar, datranga*, Hind.; *Bentea, chamrór*, Jeypore; *Tamboli*, Banda; *Mosonea, guachipo*, Uriya; *Dotti, disti, gilchi*, Gondi; *Datranga*, Mar.; *Paldatam, redda pul-mera, seregad*, Tel.; *Addula*, Tam.; *Kappura, adak*, Kan.; *Chavandi*, Mal.

A moderate-sized tree. *Bark* ⅓ in. thick, grey. *Wood* greyish- or brownish-white, moderately hard, even-grained. *Annual rings* indistinctly marked. *Pores* small, grouped in small clusters or radial lines. *Medullary rays* fine, short, numerous, distinctly visible on a radial section.

Throughout India, in deciduous forests, extending north to the Lower Himalaya of the extreme north-west and up to 2000 ft.

A very common plant in the deciduous forests of India, frequent in Sál forest and in mixed forests in the sub-Himalayan region, also on the lower hills of the

Himalaya, the Siwaliks and the hills of Central and South India. It coppices easily and reproduces well, but is of little value. Growth moderate, 5 to 8 rings per inch of radius. The wood is tough and durable, and is used for agricultural implements and in building. The fruit is eaten, as is also the inner bark in times of famine.

		lbs.
O 257.	Garhwal (1868)	33
C 1155.	Ahiri Reserve, Central Provinces (R. Thompson)	38
D 3870.	Horsleykonda, Cuddapah, 4000 ft. (Gamble)	—

Var. *aspera*, *E. aspera*, Roxb. Fl. Ind. i. 598; Bedd. Fl. Sylv. clxvi.; Brandis For. Fl. 340; Kurz For. Fl. ii. 209. Vern. *Tella júvi*, Tel.

A small tree. *Bark* greyish-white, thin. *Wood* brownish-white, moderately hard, even-grained. *Pores* moderate-sized, in radial strings of from 1 to 8, between the numerous fine *medullary rays*, which they touch on either side.

South India, in dry places.

		lbs.
D 3972.	Madras	45

3. E. obtusifolia, Hochst.; Fl. Br. Ind. iv. 142; Brandis For. Fl. 340; Talbot Bomb. List 145.

A small shrub. *Bark* grey, thin. *Wood* resembling in structure that of *E. lævis*.

Salt Range in the Punjab, Sind and Rajputana; Meiktila in Upper Burma.

P 3245. Ajmere.

4. E. Wallichiana, Hook. f. and Th.; Fl. Br. Ind. iv. 143; Gamble Darj. List 57. Vern. *Boeri*, *dowari*, Nep.; *Kalet*, Lepcha.

A large tree, sometimes gregarious. *Wood* yellowish-white, moderately hard, rough. *Annual rings* marked by light-coloured belts. *Pores* small and moderate-sized, in scattered groups and short radial lines. *Medullary rays* short, numerous, fine, uniform.

Eastern Himalaya, in Sikkim and Bhutan, at 2–7000 ft.; Shan Hills of Burma at 5000 ft.

A very common tree in the Darjeeling Hills, especially in second-growth forest, where it frequently comes up gregariously. Growth moderate, 7 rings per inch of radius. Weight about 36 to 37 lbs. per cubic foot. The wood is used for building, for charcoal, and occasionally for making tea-boxes.

		lbs.
E 690.	Sepoydura Forest, Darjeeling, 5500 ft. (Johnston)	33
E 3597, 3601.	Darjeeling Hills, 6000 ft. (Gamble)	40
	Nordlinger's Sections, vol. 10.	

3. RHABDIA, Mart.

1. R. lycioides, Mart.; Fl. Br. Ind. iv. 145; Trimen Fl. Ceyl. iii. 197. *R. viminea*, Dalz. and Gibs.; Brandis For. Fl. 341, 577; Kurz For. Fl. ii. 211; Talbot Bomb. List 145.

A shrub. *Wood* white, soft. *Pores* small, scanty, often subdivided or in short radial lines. *Medullary rays* extremely fine, very indistinct.

Rocky, sandy and shingly beds of streams in Kumaon, ascending to 2500 ft.; Central, Western and South India; Burma; scarce in Ceylon.

C 3475. Koel River, Saranda, Singbhúm (Gamble).

4. TOURNEFORTIA, Linn.

About 12 species, erect or straggling or climbing shrubs or (in one case) a small tree. *T. argentea*, Linn. f.; Fl. Br. Ind. iv. 145; Trimen Fl. Ceyl. iii. 198; Vern.

Karan, Cingh., is a small tree 10 to 12 ft. high, with short trunk and deeply furrowed bark, found on sandy seashores on the South and East Coasts of Ceylon, also in the Nicobar Islands, said by Trimen to be an "extremely beautiful little tree." *T. reticosa*, Wight is a straggling species not uncommon in the Wynaad and Coorg; and *T. Wightii*, Clarke is found in much the same region. *T. ovata*, Wall. is a climbing shrub of Burma; *T. Roxburghii*, Clarke is found in Chittagong; *T. viridiflora*, Wall., *T. Candollei*, Clarke and *T. khasiana*, Clarke, in various parts of Assam. *T. Walkeræ*, Clarke is found in Ceylon.

1. **T. Hookeri**, Clarke; Fl. Br. Ind. iv. 147; Gamble Darj. List 58. Vern. *Ampati-lara*, Nep.; *Tungrongrik*, Lepcha.

A climbing shrub. *Bark* brown, rough. *Wood* brown, soft. *Pores* large, much subdivided. *Medullary rays* fine, numerous, bent round the pores.

Sikkim Himalaya, at 2–5000 ft., common.

E 3299. Chunbati, Darjeeling, 3000 ft. (Gamble).

ORDER LXXVI. CONVOLVULACEÆ.

An Order containing chiefly climbing shrubs of very little interest to the Forest Officer, except that the largest of them are harmful to trees and have to be cut; while one, *Porana paniculata*, is to some extent an article of minor produce in N. India, being in demand for basket-making. There are seven genera, all belonging to the Tribe CONVOLVULEÆ, viz. Erycibe, Rivea, Argyreia, Lettsomia, Ipomæa, Porana and Neuropeltis. Many species of the Order have beautiful flowers, and many are cultivated in gardens. *Cuscuta*, the "Dodder," is another genus worthy of mention on account of its being parasitic, one species especially, *C. reflexa*, Roxb.; Fl. Br. Ind. iv. 225, doing great harm to small trees and hedges, which may be seen covered with its flowers and branches as with a yellowish-green sheet. It is especially fond of some trees, such as *Zizyphus Jujuba* and *Vitex Negundo*, and if left alone is capable of killing them.

Blinkworthia lycioides, Choisy. has lately (Journ. Linn. Soc. xviii. 94) been reported to be a common bush in the dry forests of Burma, flowering in the rainy season, with white waxy flowers.

The *wood* of the climbing Convolvulaceæ shows a structure of great interest, which deserves study and requires really to be fully illustrated in order to be properly understood. The woody part of the stems usually alternates with rings, either complete or broken and anastomozing, of bast tissue. The *pores* are large and the *medullary rays* inconspicuous.

1. ERYCIBE, Roxb.

Nine species, climbing or straggling shrubs. *E. glomerata*, Wall.; Fl. Br. Ind. iv. 183; Kurz For. Fl. ii. 213, is an "evergreen erect shrub" (Kurz) or "powerful scandent shrub" (Fl. Br. Ind.) of Tenasserim; where also are found *E. coriacea*, Wall. and *E. glaucescens*, Wall., the former also of Chittagong.

1. **E. paniculata**, Roxb. Fl. Ind. i. 585; Fl. Br. Ind. iv. 180; Brandis For. Fl. 344; Kurz For. Fl. ii. 214; Talbot Bomb. List 146; Trimen Fl. Ceyl. iii. 205. Vern. *Katapergu*, Uriya; *Kari*, Sonthal; *Urumin*, Kól; *Eta-miriya, etambiriya*, Cingh.

A large climbing shrub. *Bark* brown with large rough corky lenticels. *Wood* soft, porous, of peculiar structure; round the central pith radiate a series of wedges of wood tissue; round these comes a layer of bast (?) tissue; then a series of separate round, concentrically arranged masses of wood tissue, separated by bast tissue, then more layers of bast and similar masses of wood tissue, gradually getting

smaller outwards. In the wood tissue the *pores* are large and the *medullary rays* very fine.

Throughout India, from the forests of Oudh eastward and southward to Ceylon, Tenasserim and the Nicobars.

C 3497. Ghatsila, Singbhúm (Gamble).
C 4342. Kullada Forest, Ganjam (Gamble).

2. **E. lævigata,** Wall.; Fl. Br. Ind. iv. 181; Gamble Darj. List 58.

A large climbing shrub. *Bark* grey, with white corky lenticels. *Wood* greyish-white, structure similar to that of *E. paniculata.*

Sikkim Himalaya at 5–6000 ft.; Khasia Hills, 4000 ft.

E 3726. Sureil, Darjeeling Hills, 5500 ft. (Gamble).

2. RIVEA, Chois.

Two species. *R. ornata,* Chois.; Fl. Br. Ind. iv. 183; Gamble Darj. List 58; Talbot Bomb. List 146; Trimen Fl. Ceyl. iii. 205 (*Lettsomia ornata,* Roxb. Fl. Ind. i. 496, *Argyreia ornata,* Sweet, Brandis For. Fl. 343); Vern. *Muchuddai,* Tam., is a climbing shrub of South India, in dry forests in the Deccan and of the dry districts of Ceylon. The flowers are large, cream-coloured, sweet-scented and open at night, and the leaves are very white-tomentose. The var. *Griffithii* is an erect-growing plant of the Saharanpur Siwaliks and eastward to the Sikkim Terai, with much less tomentose leaves. I feel sure it is a separate species from *R. ornata* of the Fl. Br. Ind.; and, with Dr. Prain, consider it the true *R. ornata* and the South Indian plant (the *Convolvulus candicans,* Roxb.) to be a separate species.

1. **R. hypocrateriformis,** Chois.; Fl. Br. Ind. iv. 184; Talbot Bomb. List 146. *Argyreia uniflora,* Sweet; Brandis For. Fl. 342. *Lettsomia Bona-nox* and *L. uniflora,* Roxb. Fl. Ind. i. 494–5. "Midnapore creeper" or "Clove-scented creeper." Vern. *Kulmi-luta,* Beng.

A climbing shrub. *Bark* very thin, grey. *Wood* soft, porous, in concentric rings, alternating with concentric rings of bast tissue. In the concentric rings, the wood is partitioned into wedges by the broad *medullary rays,* and the large *pores* are seen in a radial line of 2 or 3 in the wedge between each pair of medullary rays.

Dry forests and hedges of the Peninsula, extending north through Rajputana to the Punjab, but most common on the coasts on either side and in the Deccan country.

D 3886. Muchukota Forest, Anantapur (Gamble).

3. ARGYREIA, Lour.

In the Fl. Br. Ind. 25 species are given, most of which are climbing shrubs of considerable size, most of them handsome, but of comparatively little interest as they do not grow so much in the forests as on the forest edges, among bushes near villages, in hedges and ravines. *A. tiliæfolia,* Wight; Fl. Br. Ind. iv. 184; Kurz For. Fl. ii. 215; Trimen Fl. Ceyl. iii. 206; Vern. *Taungkazungyi,* Burm.; *Giri-tilla,* Cingh., is a large climber of Bengal, Burma and Ceylon, common along streams. *A. cuneata,* Ker; Fl. Br. Ind. iv. 191; Brandis For. Fl. 344; Talbot Bomb. List 147, is an erect shrub with deep purple flowers, common in dry districts of Western and Southern India. *A. pallida,* Chois. is a handsome climber of the Meiktila forests in Burma (Collett in Journ. Linn. Soc. xviii. 94).

1. **A. speciosa,** Sweet; Fl. Br. Ind. iv. 185; Brandis For. Fl. 343; Talbot Bomb. List 146. The Elephant creeper. Vern. *Samudra shoka, guguli,* Bombay.

A large climber. *Bark* grey, peeling off in papery flakes. *Wood* grey, structure like that of *Rivea hypocrateriformis,* being divided into concentric rings by belts of bast tissue alternating with woody belts, which later are again divided into wedges by the broad

medullary rays. *Pores* few, large, in groups in the tissue between the medullary rays.

Western and Southern India and Bengal.

D 3997. Ramundrúg, Bellary, 3000 ft. (Gamble).

4. LETTSOMIA, Roxb. About 17 species are described in the Fl. Br. Ind., all climbers, some of considerable size.

5. IPOMÆA, Linn. A large genus of which only a few are of shrubby size. The most noticeable of these is the "Moonflower," *I. Bona-nox*, Linn.; Fl. Br. Ind. iv. 197; Kurz For. Fl. ii. 217; Trimen Fl. Ceyl. iii. 213 (*I. grandiflora*, Roxb. Fl. Ind. i. 497); Vern. *Alanga*, Cingh., whose large white sweet-scented flowers open only at night, and are conspicuous in hedges and ravines in the early morning in many parts of India. *I. biloba*, Forsk.; Fl. Br. Ind. iv. 212, is the Goats'-foot Creeper, which is important as a very efficient binder of the coast sands on most of the Indian shores. It has bilobed leaves and conspicuous purple-red flowers.

6. PORANA, Burm.

About 8 species. *P. racemosa*, Roxb. Fl. Ind. i. 466; Fl. Br. Ind. iv. 222; Gamble Darj. List 58; Vern. *Papray*, Nep.; *Mom-rik*, Lepcha, is a climbing shrub of the Central and Eastern Himalaya, common in the Darjeeling Hills up to 5000 ft. It is sometimes called the "Snow creeper" from its masses of white flowers covering the forest trees.

1. **P. paniculata,** Roxb. Fl. Ind. i. 464; Fl. Br. Ind. iv. 222; Brandis For. Fl. 342; Kurz For. Fl. ii. 220; Gamble Darj. List 58. The Silver Creeper. Vern. *Bel kamún*, Hind.; *Burhi lat*, Monghyr; *Badulpati*, Nep.; *Kadiwan*, Lepcha.

A large climbing shrub. *Bark* light yellowish-white, corky, with spirally-arranged rounded darker bosses. *Wood* white, very porous, soft, in concentric masses separated by belts of bast tissue which irregularly anastomoze. *Pores* large, numerous. *Medullary rays* fine, very inconspicuous.

Sub-Himalayan tract from the Ganges eastwards, Bengal and Upper Burma.

In the Siwaliks the stems are cut for making baskets for rough use, as for road excavation.

O 4655. Saharanpur Forests (Gamble).

The structure of *P. volubilis*, Burm. is similar (Nordlinger's Sections, vol. 4). It is a Malay species which may possibly extend to Tenasserim.

7. NEUROPELTIS, Wall. *N. racemosa*, Wall.; Fl. Br. Ind. iv. 225; Kurz For. Fl. ii. 222, is a large climbing Burmese shrub.

ORDER LXXVII. SOLANACEÆ.

An Order of no great forest interest, though of considerable economic importance, producing, as it does, such valuable plants as the potato, capsicum, tomato, tobacco, and Cape gooseberry. Three genera, however, require notice, viz.—

Tribe I. Solaneæ . . . . Solanum, Withania.
„ II. Atropeæ . . . . Lycium.

Datura arborea, Linn. with white and *D. sanguinea*, R. and P. with orange long-tubed flowers are common garden shrubs, often found as escapes or self-sown,

1. SOLANUM, Linn.

Many species: herbs, shrubs or small trees, some of them semi-shrubby roadside plants like *S. torvum*, Sw. and *S. indicum*, Linn., but only a few really woody. *S. pubescens*, Willd.; Fl. Br. Ind. iv. 230, is a shrub of the dry rocky hills of the

South Deccan. *S. giganteum*, Jacq.; Fl. Br. Ind. iv. 233; Talbot Bomb. List 150; Trimen Fl. Ceyl. iii. 150; Vern. *Kutri, chelna jhár, chunna jhár*, Mar., is a small tree of the Western Gháts, the Nilgiris, and the hills of Ceylon, at 3–7000 ft., with very white woolly leaves and small blue flowers. *S. ferox*, Linn.; Fl. Br. Ind. iv. 233; Kurz For. Fl. ii. 226; Trimen Fl. Ceyl. iii. 233; Vern. *Sinkadi*, Burm.; *Malabatu*, Cingh., is a large herbaceous shrub of Eastern Bengal, Ceylon and Burma, where it is common in old cultivated lands and on old village sites.

S. jasminoides, Paxt. is a climbing shrub with white flowers, very common in Indian gardens.

1. **S. verbascifolium**, Linn.; Fl. Br. Ind. iv. 230; Kurz For. Fl. ii. 25; Gamble Darj. List 58; Talbot Bomb. List 150; Trimen Fl. Ceyl. iii. 232. *S. pubescens*, Roxb. Fl. Ind. i. 564. Vern. *Urusa*, Beng.; *Dursal*, Nep.; *Sivor*, Lepcha; *Hékarilla*, Cingh.

A large shrub or small tree. *Bark* grey, smooth. *Wood* soft, light yellow. *Pores* moderate-sized, scanty, often subdivided, the annual rings marked by a line of rather larger pores. *Medullary rays* fine, short, numerous.

Throughout India, in ravines or shady places under big trees; from the Jumna eastwards along the hills to Assam and Burma, and down both coasts; moist region of Ceylon.

E 3344. Kalimpúng, Darjeeling, 4000 ft. (Gamble).

2. WITHANIA, Pauq. Two small shrubs, *W. somnifera*, Dunal and *W. coagulans*, Dunal; Fl. Br. Ind. iv. 239, 240, the former of the drier parts of Northern India; the latter of the Punjab, Sind and adjoining regions. The fruit of this plant is commonly employed as a substitute for rennet to coagulate milk.

3. LYCIUM, Linn. Three species, of which the most common is *L. europæum*, Linn.; Fl. Br. Ind. iv. 240; Brandis For. Fl. 345; Talbot Bomb. List 150; Vern. *Ganger, kangu, kúnga búti*, Punjab; *Chirchitta, niral*, Delhi; *Gangro, chirchitta*, Mar., is a thorny shrub of the Punjab, Sind and Guzerat. The wood is used for fuel and the branches are made into wattled frames for the walls of huts; the fruit is eaten. *S. barbarum*, Linn. is found in the Punjab and Sind; and *S. ruthenicum*, Murray; Brandis For. Fl. 346; Vern. *Khichar, khitsar, kitserma*, Ladak, is found at high elevations, 6–13,000 ft. in the higher inner Himalaya, and also has an edible fruit.

ORDER LXXVIII. SCROPHULARIACEÆ.

An Order containing many herbaceous plants, but, in India, only two genera reaching woody size, viz. Brandisia and Wightia, both belonging to the Tribe Cheloneæ.

1. BRANDISIA, Hook. f. and Th. *B. discolor*, Hook. f. and Th.; Fl. Br. Ind. iv. 257; Kurz For. Fl. ii. 250, is an evergreen half-scandent shrub of the hill forests of Martaban, at 3–6000 ft.

2. WIGHTIA, Wall.

1. **W. gigantea**, Wall.; Fl. Br. Ind. iv. 257; Gamble Darj. List 59. Vern. *Lakori*, Nep.; *Bop*, Lepcha.

A large erect or epiphytic tree. *Bark* grey, smooth, of unequal thickness, on the outside ¼ in. thick, much thinner where it touches the stem of the supporting tree. *Wood* white, very soft, porous. *Pores* large, often subdivided, equally distributed. *Medullary rays* moderately broad, uniform, bent round the pores.

Central and Eastern Himalaya, from Nepal to Bhutan, at 3–7000 ft.; Manipur (Watt); Salween Valley, Burma, 3000 ft. (Brandis); Shan Hills at 4000 ft. (Aplin).

In Hooker's "Himalayan Journal," vol. i. 164, where a picture of it is given, it is spoken of as with stem-clasping *Ficus*-like branches, and this as I have always seen it; in the "Fl. Br. Ind.," however, it is described as "a large tree, often half 'epiphytic;" and Watt mentions it ("Ind. Forester," xiv. 348) as "a large tree." In

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pattern. *Medullary rays* fine, td climber, *T. capensis*, Lindl., *T. radi-*
what larger than the transverse orange flowers.
on a vertical section. 8; Brandis For. Fl. 352; Talbot Bomb.

Cultivated in avenues and gardens in i. 101. Vern. *Reodána, rebdán*, Trans-
in Burma and the Malay Archipelago. , *lohéro*, Sind; *Roira*, Merwara; *Rakht*
'forests from Martaban down to Tenasse

A fine tree with white sweet-scente *Bark* ¼ in. thick, corky, reddish-
and ornamental. It has been much use -brown, close-grained, mottled
be damaged by storms. It produces qu nd moderate-sized, often sub-
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Skinner gives (No. 27) W = 42 lbs., P : bloom in March and April, it is a most
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Kumaon; *Tattunúa*, C.P.; *Phalgatetu*, *P.*
Nep.; *Kering*, Gáro; *Cherpong*, Mec *rk* light brown, corky. *Wood*
Sanpatti, Monghyr; *Bana hata*, Sontha *Pores* small, rather scanty.
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P 111. Sutlej Valley . . . ONE, Fenzl.
C 1179. Ahiri Reserve, Central Pro
E 582. Khookloong Forest, Darje eem.; Fl. Br. Ind. iv. 380 (*Spathodea*
E 2396. Bamunpokri, Darjeeling (ll tree of Rajputana, the C.P. and the
D 4178. Mantralakanama Pass, K us and with a straight capsule.

South Deccan. *S. giganteum*, Jacq.; Fl. Br. Ind. iv. 233; Talbot Bomb. List 150; Trimen Fl. Ceyl. iii. 150; Vern. *Kutri, chelna jhár, chunna jhár*, Mar., is a small tree of the Western Ghâts, the Nilgiris, and the hills of Ceylon, at 3–7000 ft., with very white woolly leaves and small blue flowers. *S. ferox*, Linn.; Fl. Br. Ind. iv. 233; Kurz For. Fl. ii. 226; Trimen Fl. Ceyl. iii. 233; Vern. *Sinkadi*, Burm.; *Malabatu*, Cingh., is a large herbaceous shrub of Eastern Bengal, Ceylon and Burma, where it is common in old cultivated lands and on old village sites.

S. jasminoides, Paxt. is a climbing shrub with white flowers, very common in Indian gardens.

1. **S. verbascifolium**, Linn.; Fl. Br. Ind. iv. 230; Kurz For. Fl. ii. 25; Gamble Darj. List 58; Talbot Bomb. List 150; Trimen Fl. Ceyl. iii. 232. *S. pubescens*, Roxb. Fl. Ind. i. 564. Vern. *Urusa*, Beng.; *Dursal*, Nep.; *Sivor*, Lepcha; *Hékarilla*, Cingh.

A large shrub or small tree. *Bark* grey, smooth. *Wood* soft, light yellow. *Pores* moderate-sized, scanty, often subdivided, the annual rings marked by a line of rather larger pores. *Medullary rays* fine, short, numerous.

Throughout India, in ravines or shady places under big trees; from the Jumna eastwards along the hills to Assam and Burma, and down both coasts; moist region of Ceylon.

E 3344. Kalimpúng, Darjeeling, 4000 ft. (Gamble).

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E 2396. Bamunpokri, Darjeeling (all tree of Rajputana, the C.P. and the
D 4178. Mantralakanama Pass, K bus and with a straight capsule.

Pores rather scanty, small to moderate-sized, in oblique lines and sometimes in concentric bands. *Medullary rays* fine, numerous. Texture, colour and hardness variable.

1. D. **stipulata**, Benth.; Fl. Br. Ind. iv. 379. *Spathodea stipulata*, Wall.; Kurz For. Fl. ii. 234. *S. velutina*, Kurz For. Fl. ii. 235. *Bignonia stipulata*, Roxb. Fl. Ind. iii. 108. Vern. *Mahlwa, paukkyan*, Burm.

A moderate-sized deciduous tree. *Wood* orange-red, beautifully mottled, hard, close-grained. *Pores* small, enclosed in round patches of soft tissue which are often arranged in wavy, concentric lines in one direction, and in short slanting lines in another. *Medullary rays* prominent, very fine, very numerous, generally filled with a yellow substance.

Open and drier upper mixed forests of Burma; Andaman Islands.

Weight: Brandis' Burma List, 1862, No. 77, gives 48 lbs.; Skinner, No. 26, gives weight 64 lbs., P = 1386; specimens examined give 56 lbs. per cubic foot. The wood is used for bows, spear-handles, oars and paddles. Major Ford says it is a durable wood for house-posts and makes good furniture. Flowers orange-yellow.

		lbs.
B 2544.	Burma (Brandis, 1862)	58
B 2261.	Andaman Islands (Col. Ford, 1866)	54

2. D. **Rheedii**, Seem.; Fl. Br. Ind. iv. 379; Trimen Fl. Ceyl. iii. 282. *Spathodea Rheedii*, Wall.; Bedd. Fl. Sylv. clxviii.; Kurz For. Fl. ii. 234. Vern. *Gorshingiah*, Beng.; *Vilpadri*, Tam.; *Diyadanga*, Cingh.; *Thakutma*, Burm.

A moderate-sized deciduous tree. *Wood* white, soft. *Pores* small, often subdivided, in wavy, narrow, concentric bands. *Medullary rays* very fine, very numerous, prominent on a vertical section.

Plains of the West Coast in Malabar and Travancore; Sundarbans (Heinig); mixed forests of Burma; Andaman Islands; moist low country of Ceylon.

Growth moderate, 7 to 13 rings per inch of radius. Weight 23 lbs. (Adrian Mendis); the specimens examined give 32 to 39 lbs.; Brandis' Burma List, 1862, No. 79, gives 35 lbs. Flowers white.

		lbs.
B 2545.	Burma (Brandis, 1862)	32
B 2252.	Andaman Islands (Col. Ford, 1866)	39
No. 18,	Ceylon Coll., old (marked *Spathodea longifolia*), also new	23 (doubtful)

3. D. **crispa**, Seem.; Fl. Br. Ind. iv. 379; Talbot Bomb. List 152. *Spathodea crispa*, Wall.; Bedd. Fl. Sylv. clxviii.; Brandis For. Fl. 350. *Bignonia crispa*, Buch.; Roxb. Fl. Ind. iii. 103. Vern. *Padri, padar*, Berar; *Tetu*, Kurku; *Pumbadri, nirvuddi*, Tel.

A moderate-sized tree. *Bark* ¾ in. thick, brown, rough. *Wood* light yellowish-brown, moderately hard, even-grained. *Pores* moderate-sized, often subdivided, scanty, surrounded by light rings and arranged in concentric lines, where they are joined by fine lines of loose tissue. *Medullary rays* fine, numerous, wavy.

Deciduous forests of the Deccan; common in the Ceded Districts.

An interesting tree with white flowers and a long curved capsule. It has a wood of good quality, useful for building and in fair demand.

		lbs.
D 4001.	Cuddapah Forests (Higgens)	44

4. D. **falcata**, Seem.; Fl. Br. Ind. iv. 380; Talbot Bomb. List 152. *Spathodea falcata*, Wall.; Bedd. Fl. Sylv. t. 71; Brandis For. Fl. 350. *Bignonia spathacea*, Roxb. Fl. Ind. iii. 103. Vern. *Háwar*, Oudh; *Kanséri*, Meywar; *Mendal, manshingi*, Banswara; *Mersingi, medasinghi*, Mar.; *Udda, wodi, chittivadi, chittiwothi*, Tel.; *Mersingh*, Bhil; *Karanjelo*, Kurku; *Nir pongilam*, Mal.

A small deciduous tree. *Bark* ½ in. thick, bluish-grey, exfoliating in irregular woody scales. *Wood* whitish, hard, close- and even-grained, seasons well, shining and glossy; no heartwood. *Annual rings* indistinct. *Pores* small, oval and subdivided, arranged in wavy, narrow, concentric bands. *Medullary rays* very fine, very numerous.

Oudh (Brandis), Rajputana, Central and South India, in deciduous forest, but chiefly on dry rocky slopes.

A curious and interesting little tree. The Oudh locality is somewhat doubtful, as is the Oudh name.

Growth moderate, 7 to 8 rings per inch of radius. Weight 42 to 58 lbs. per cubic foot, but the last specimen may have been unseasoned when weighed. The wood is used for building and agricultural purposes (Bedd.). Flowers white, leaves small, capsule flat, falcate.

		lbs.
C 1139.	Ahiri Reserve, Central Provinces (R. Thompson)	42
C 995.	Sahyádri Gháts, Ahmednagar (Shuttleworth) . . .	43
D 4162.	Dhone, Kurnool (Gamble)	58

5. **D. arcuata,** Clarke; Fl. Br. Ind. iv. 380. *Spathodea arcuata*, Wight; Bedd. Fl. Sylv. clxix. Vern. *Ran-palai*, Tam.; *Mersingi*, Mar.

A moderate-sized tree. *Bark* light brown, ⅛ in. thick, peeling off in small flakes. *Wood* white, moderately hard, resembling that of *Gmelina arborea*. *Pores* small, sometimes subdivided, scanty, surrounded by light tissue and arranged in somewhat concentric lines which often meet. *Medullary rays* fine, numerous.

Hills of South India, in the forests of Coimbatore and Palghát.

D 3980. Agri-Hort. Gardens, Madras (Steavenson).

7. HETEROPHRAGMA, DC.

Three species.

Pores moderate-sized, ringed. *Medullary rays* fine, the distance between the rays being equal to or greater than the transverse diameter of the pores. No regular distinct concentric bands.

1. **H. sulfureum,** Kurz For. Fl. ii. 235; Fl. Br. Ind. iv. 381. Vern. *Thitlinda, kyaungletto*, Burm.

A moderate-sized deciduous tree. *Wood* dark brownish-grey, hard, rather resembling a dark Teak wood that has been embedded in salt mud. *Pores* moderate-sized, surrounded by pale rings and more or less grouped, the groups usually in short oblique lines, occasionally (*? annual rings*) in concentric ones.

Dry forests of Prome and along the Pegu Yoma in Burma, extending to the Shan Hills Terai at 1000 ft.

A useful-looking wood. Brandis' Burma List, 1862, No. 78, gives W = 63 lbs., but his specimen now weighs 42 lbs. Flowers yellow.

		lbs.
B 2547.	Burma (Brandis, 1862)	42

2. **H. Roxburghii,** DC; Fl. Br. Ind. iv. 381; Bedd. Fl. Sylv. clxix.; Talbot Bomb. List 153. *Spathodea Roxburghii*, Spr.; Brandis For. Fl. 350. *Bignonia quadrilocularis*, Roxb. Fl. Ind. iii. 107. Vern. *Baro-kala-goru*, Tam.; *Bondgu*, Tel.; *Pullung, wurus, panlag*, Mar.; *Kalavada*, Koya; *Pambapena*, Reddi.

A large tree. *Bark* ½ in. thick, dark brown, exfoliating in small angular scales. *Wood* grey, rough, moderately hard, no heartwood, no *annual rings*. *Pores* moderate-sized, uniformly distributed. *Medullary rays* fine, visible on a radial section as long narrow plates.

Chanda District, Godavari Forests and Western Coast, in deciduous forest.

A noticeable tree, not at all uncommon along the Godavari river in Bhadrachalam, Rekapalle and Rumpa in the Madras Presidency; in Sironcha and Chanda in the C.P., and probably also in the Hyderabad forests south of the river.

Growth moderate, 7 rings per inch of radius. Weight 40 lbs. per cubic foot. Flowers rose-coloured.

	lbs.
C 1106. Ahiri Reserve, Central Provinces (R. Thompson) . . .	40

No. C 3944 from the Rekapalle Forests, Upper Godavari, differs in structure. "*Wood* yellowish-white, hard, close- and even-grained. *Pores* small, rather scanty, evenly distributed. *Medullary rays* fine to moderately broad. Weight 52 lbs." If I had not cut it myself, I should doubt its identification; and it may possibly be that some substitution has taken place in one or other specimen.

3. **H. adenophyllum,** Seem.; Fl. Br. Ind. iv. 381; Kurz For. Fl. ii. 236. Vern. *Petthan*, Burm.

A moderate-sized deciduous tree. *Wood:* sapwood light yellow; heartwood orange-yellow, with occasional darker streaks, moderately hard to hard. *Pores* moderate-sized, ringed, filled with yellow resinous matter, uniformly distributed, but occasionally running into more or less concentric lines. *Medullary rays* fine to moderately broad, the distance between them equal to or greater than the diameter of the pores, giving a good silver-grain.

Upper mixed forests in Burma and the Andaman Islands; often cultivated in Indian gardens. Prain says it is common in the Coco Islands.

A handsome tree, with large leaves and large brownish-yellow flowers. The wood is well deserving of being better known, and becoming possibly, if the tree is sufficiently common, an export timber. Ferrars (Andamans List, Calcutta Exhibition, 1883–84) says it does not warp or split, and is excellent for cabinet-work. It is not clear whether it can be obtained in large size or not; at any rate, this should be investigated. Ferrars' specimen gives W = 52 lbs.

	lbs.
B 1421. Tharrawaddy, Burma	42

Nordlinger's Sections, vol. 9 (sapwood) (Tab. XI. 4).

8. MAYODENDRON, Kurz. *M. igneum*, Kurz Prel. Rep. Pegu, Appx. D. and For. Fl. ii. 233; Fl. Br. Ind. iv. 382; Vern. *Ekarit*, Upper Burma, is a handsome tree with scarlet flowers found in the Martaban Hills up to 2000 ft., also as far north as the Kachin Hills in Upper Burma.

9. STEREOSPERMUM, Cham.

About eight species, all trees. *S. hypostictum*, Miq.; Fl. Br. Ind. iv. 384 (*Radermachera amœna*, Seem.; Kurz For. Fl. ii. 232), is a small tree of Upper Burma and Tavoy. *S. glandulosum*, Miq. and *S. Wallichii*, Clarke are also scarce Burmese trees, the latter of the Irrawaddy estuary.

Wood greyish-brown, heartwood (if present) yellowish-brown. *Pores* small to large, variable in size, scanty, surrounded by loose tissue, the patches joined into more or less concentric belts. *Medullary rays* fine to moderately hard, rather scanty.

1. **S. chelonoides,** DC; Fl. Br. Ind. iv. 382; Bedd. Fl. Sylv. t. 72; Brandis For. Fl. 352; Kurz For. Fl. ii. 230; Gamble Darj. List 59; Talbot Bomb. List 153; Trimen Fl. Ceyl. iii. 283. *Bignonia chelonoides*, Linn.; Roxb. Fl. Ind. iii. 106. Vern. *Pader, padri, parral*, Hind.; *Parari*, Nep.; *Singyen*, Lepcha; *Sirpang*, Mechi; *Bolzel*, Gáro; *Paroli*, Ass.; *Pareya-auwal*, Cachar; *Dharmara, atcapali*, Beng.; *Tsaingtsa*, Magh; *Padri, pon-padira, pathiri, pumbathri, padri, vela-padri*, Tam.; *Tagada, thágu, kala gorú, moka yapa, pisúl*, Tel.; *Taitu*, Berar; *Pamphunia*, Uriya; *Kirsel, tuatuka, padul, paral*, Mar.; *Patoli*, Khond; *Kandior*, Kól; *Padurni*, Bhil; *Nai-udi, mallali,*

Coorg; *Kall-udi*, Kan.; *Kuring kura*, Mal.; *Lúnú-madala, dunu-madala*, Cingh. *Singwe, thakutpo*, Burm.

A large deciduous tree. *Bark* brown, varying in thickness up to ½ in., outer bark corky. *Wood* hard, grey, no heartwood. *Pores* moderate-sized and large, joined by narrow, irregular, wavy, interrupted belts and lines of soft tissue. *Pores* frequently filled with a white substance of a resinous nature, which is prominent on a vertical section. *Medullary rays* short, wavy, moderately broad, numerous, prominent on a radial section as long, narrow, horizontal bands.

Moister parts of India: sub-Himalayan tract and Lower Himalaya from Oudh eastwards, rising to 2000 ft. in the Darjeeling Hills, where it is common; Assam, Eastern Bengal and Chittagong; mixed forests throughout Burma, rising to 4000 ft. in the Shan Hills; Orissa and the Circars, but scarce; C.P. and Berar; Western Coast from the Konkan downwards; also in the Carnatic, but more scarce; moist low country of Ceylon, up to 2000 ft.

An important tree. Peal says that in Assam it is found with a long clean stem, 40 to 50 ft. high and 5 to 6 ft. in girth, and it is the same in Darjeeling. Beddome describes the wood as "orange-yellow;" perhaps this is a heartwood which may appear so under some conditions. Graham Anderson says it gives out suckers very largely.

Growth moderate, about 7 rings per inch of radius. Weight 45 lbs. (Kyd); 42·5 lbs. (Wallich); 48 lbs. (Skinner, No. 25); 42 lbs. (Bourdillon); 47 lbs. (H. H. O'Connell); specimens enumerated give 47 lbs. Kyd gives P = 710; Skinner 642; Bourdillon 772. The wood is moderately durable, elastic, easy to work; it is used for building and is good for furniture. It is used for canoes and building in Assam, and for tea-boxes in Cachar. The roots, leaves and flowers are used medicinally, and the flowers in Hindu temples.

		lbs.
C 1164, 1172.	Ahiri Reserve, Central Provinces (R. Thompson)	40 and 38
C 1411.	Moharli " " " (Col. Doveton)	46
C 833.	Bairagarh Reserve, Berar (Drysdale)	—
E 659.	Khookloong Forest, Darjeeling Terai (Manson)	51
E 673.	Bamunpokri Forest " " "	48
E 632.	Eastern Dúars, Assam (Mann)	40
E 1398.	Chittagong (Chester)	59
D 1070.	North Arcot (Beddome)	50
B 2546.	Burma (Brandis, 1862)	52
B 5041.	Pegu Division, Burma	—

2. **S. neuranthum**, Kurz For. Fl. ii. 230; Fl. Br. Ind. iv. 382. Vern. *Thande*, Burm.

A deciduous tree. *Bark* ½ in. thick, light brown, smooth, soft. *Wood* greyish-brown, no heartwood, hard. *Pores* moderate-sized to large, scanty, surrounded by soft tissue, the patches joined into somewhat concentric but anastomozing bands; prominent on vertical sections as dark lines. *Medullary rays* fine, rather distant, short, wavy.

Mixed forests of the Pegu Yoma in Burma.

Kurz speaks well of this wood as being "rather heavy," but gives 33 to 36 lbs. only as its weight. A good specimen, however, sent to the Paris Exhibition of 1900, as a "paving block," gave W = 48 lbs. It seems likely to be a useful wood of the rather heavy class. The description is from the paving-block referred to; the following specimens agree fairly well in structure, but are perhaps a little doubtful.

		lbs.
B 5018.	Tharrawaddy Division, Burma	42
B 5027.	Rangoon " "	40
B 5043.	Bassein " "	42

All from young trees.

3. **S. suaveolens**, DC; Fl. Br. Ind. iv. 382; Bedd. Fl. Sylv. clxix.; Brandis For. Fl. 351; Kurz For. Fl. ii. 231; Gamble Darj. List 59; Talbot Bomb. List 158; Trimen Fl. Ceyl. iii. 284. *Bignonia suaveolens*, Roxb. Fl. Ind. iii. 104. Vern. *Paral*,

padal, padiála, padaria, parur, Hind.; *Phallai*, Kashmir; *Tumri*, Kumaon; *Pandri*, C.P.; *Phalgataitu*, Melghát; *Parari*, Nep.; *Singyen*, Lepcha; *Parúl*, Beng.; *Patúli*, Uriya; *Parer*, Sonthal; *Paroli*, Mal Pahari; *Pandri*, Kharwar; *Parar*, Monghyr; *Kandior*, Kól; *Padri*, Tam.; *Kala-goru, kuberakashi, padari, patali*, Tel.; *Hooday, billa*, Kan.; *Unt katar, padar*, Gondi; *Padar*, Kurku; *Pandan*, Bhíl; *Parúl, kalagari, patala*, Mar.; *Palol, ela palol*, Cingh.

A large deciduous tree. *Bark* ¼ in. thick, grey, exfoliating in large, irregularly shaped, flat scales. *Wood* hard: sapwood grey; heartwood small, yellowish-brown, beautifully mottled with darker streaks, very hard, seasons and polishes well. *Pores* moderate-sized, enclosed in patches of loose texture which are more or less concentrically arranged and sometimes run together entirely into concentric belts. The pores are frequently filled with a white shining substance, which becomes yellow in the heartwood. *Medullary rays* fine, sharply defined, numerous, wavy, equidistant, prominent on a radial section.

Throughout India, in drier localities than *S. chelonoides*: sub-Himalayan tract and Lower Himalaya, from Kashmir to Sikkim, up to 4000 ft., abundant in the Siwaliks, but small; C.P. and Berar, also Rajmehal and Chota Nagpore Hills, Orissa and the Circars; deciduous forests in the Bombay Presidency and in South India; Chittagong; Eng Forests of Martaban; only planted in Ceylon.

An important tree as being one of the most common of the companions of Sál, worthy of use as regards its timber and important in sylviculture on account of its very free seed reproduction. This is, no doubt, largely due to the fruit remaining long unopened on the tree, so that the seeds only get dispersed at the very end of the hot season after the danger of fire is nearly over, and can germinate with the first rains. On the Siwalik Hills, the tree is usually rather stunted, but there too its good natural reproduction is very noticeable, even on the most exposed slopes and among grass; and it is one of the commonest trees to be seen in savannah lands, apparently able to shoot up yearly in spite of fire, and to grow on into a tree if only a short period of immunity from fire can be obtained.

The wood is durable, easy to work and good for building, but the amount of heartwood is small. It is an excellent firewood and makes good charcoal. Brandis gives W = 44 lbs., the average of specimens enumerated is 46 lbs. per cubic foot. The root and bark are used in native medicine.

		lbs.
P 4908.	Ajmere (Lowrie)	47
O 243.	Garhwal (1868)	41
O 341.	Gorakhpúr (1868)	49
O 1378.	Gonda, Oudh (Dodsworth)	—
C 197.	Mandla, Central Provinces (1869)	40
C 1114.	Ahiri Reserve, Central Provinces (R. Thompson)	46
C 2745.	Moharli ,, ,, ,, (Brandis)	50
C 832.	Bairagarh Reserve, Berar (Drysdale)	—
E 1959.	Chittagong (Chester)	51
B 307.	Burma (1867)	44

4. **S. fimbriatum**, DC; Fl. Br. Ind. iv. 383; Kurz For. Fl. ii. 231. Vern. *Thanthat*, Burm.

A deciduous tree. *Wood* very hard: heartwood small, dark brown; sapwood light brown; in structure similar to that of *S. suaveolens*.

Tropical forests of Martaban and Upper Tenasserim; Karen Hills up to 3000 ft.

		lbs.
B 2696.	Tavoy (Wallich, 1828)	54

5. **S. xylocarpum**, Wight; Fl. Br. Ind. iv. 383; Talbot Bomb. List 153. *Spathodea xylocarpa*, T. And.; Brandis For. Fl. 349, t. 43. *Bignonia xylocarpa*, Roxb. Fl. Ind. iii. 108; Bedd. Fl. Sylv. t. 70. Vern. *Kharsing, bersinge*, Mar.; *Jai-mangal, sondar-padal*, Mandla; *Dhóta mara, dhotte*, Gondi; *Teto*, Kurku; *Vadencarni, malei uthi*, Tam.; *Ghansing, hooday*, Kan.; *Udi, udé*, Coorg; *Pathiri, vedang-konnan, edang korna*, Mal.

A deciduous tree. *Bark* ¼ in. thick, light grey. Sapwood large, grey; heartwood very hard, orange-brown. *Annual rings* marked by an irregular belt of numerous pores. *Pores* small and moderate-sized, often subdivided, each pore or group of pores in a small patch of soft tissue; these patches are frequently grouped in zig-zag and more or less concentric lines. In the heartwood the pores are generally filled with a yellow substance. *Medullary rays* short, fine.

Central Provinces, in the Satpura Range; Khandésh and the Mahratta country; West Coast forests and Western Gháts, common in Wynaad and Travancore, up to 4000 ft.; Circars, Deccan and Carnatic.

A fine tree, always recognizable by its very long rough capsule, sometimes 3 ft. in length. The wood is good and handsome; it is tough and elastic and takes a good polish. It is used for cabinet-work, in Travancore for cart-poles and shafts, and deserves to be better known and to be in more general use. Bourdillon gives W = 42 lbs., P = 785.

		lbs.
C 2810.	Melghát, Berar (Brandis)	36 (sapwood)
C 958.	Guzerat, Bombay (Shuttleworth).	47
C 996.	Sahyádri Gháts, Ahmednagar (Shuttleworth) . .	47
W 4195.	Cochin (Kohlhoff)	42

Nos. E 719 (52 lbs.) from Chittagong; W 1284 (54 lbs.) from the Anamalai Hills; B 2235 (52 lbs.) and B 2234 (56 lbs.), from the Andamans, probably belong to this genus.

10. PAJANELIA, DC.

1. **P. Rheedii,** DC; Fl. Br. Ind. iv. 384; Bedd. Fl. Sylv. clxix.; Talbot Bomb. List 154. *P. multijuga*, Kurz For. Fl. ii. 237. Vern. *Kyaungdauk*, Burm.; *Kaukonda*, And.

A large evergreen tree (Burma). A small tree in S. India. *Bark* ¼ in. thick, dark grey, rough. *Wood* orange-brown, very hard, close-grained. *Pores* large, occasionally filled with yellow resin; each pore surrounded by a narrow ring of soft tissue, uniformly distributed. *Medullary rays* fine, very numerous, uniform and nearly equidistant, prominent. Wood very similar to that of *Planchonia littoralis* (p. 365), but differs by more prominent medullary rays, and larger pores, which are not arranged in bands, but isolated.

Khasia Hills and Sylhet; N. Kanara, along nálas in Yellapur; Malabar plains and up to 2000 ft. on the Gháts; mixed forests in Burma; Andaman Islands.

A tree with ornamental large flowers and large capsule. It has a fine wood, which deserves to be better known: it is used by the Andamans for canoes.

		lbs.
B 503.	Andaman Islands (Genl. Barwell)	52

11. KIGELIA, DC.

1. **K. pinnata,** DC.

A large tree. *Bark* greyish-brown, rough, ¼ in. thick. *Wood* grey, hard. *Pores* small, in irregular, sometimes interrupted concentric wavy bands of soft texture. *Medullary rays* fine, numerous.

Indigenous in Tropical Africa: largely planted in India in gardens, topes and avenues.

A handsome tree with long pendent racemes of large red-brown flowers, followed by huge cylindrical fruit. The wood is good and the growth quick, 4 rings per inch in suitable places, so that it is a good tree to grow; but if grown in the open it branches badly, and requires heavy pruning if it is to be kept straight.

		lbs.
O 4578.	Forest School Garden, Dehra Dún (Babu Birbal) . . .	44

ORDER LXXXI. ACANTHACEÆ.

An Order containing a large number of genera, mostly herbaceous or of small shrubs, only a few of which are really of interest to Forest officers. The following 13 genera contain shrubs, however, of more or less importance in various ways:—

Tribe I. Thunbergieæ	Thunbergia.
„ II. Ruellieæ	Petalidium, Dædalacanthus, Stenosiphonium, Æchmanthera, Strobilanthes, Calacanthus.
„ III. Acantheæ.	Acanthus.
„ IV. Justicieæ	Barleria, Eranthemum, Phlogacanthus, Justicia, Adhatoda.

Wood soft or moderately hard, usually white or grey. *Pores* small to moderate-sized, scanty. *Medullary rays* fine to moderately broad.

1. THUNBERGIA, Linn. f. Climbing shrubs, some quite small, a few of very large size. *T. grandiflora*, Roxb. Fl. Ind. iii. 34; *Fl. Br. Ind. iv. 392; Kurz For. Fl. ii. 240; Gamble Darj. List 59; Vern. *Mullúta*, Hind., Beng.; *Chongtafibrik*, Lepcha, is a large climber of Bengal, Assam and Chittagong, with pale blue flowers. *T. coccinea*, Wall. of the East Himalaya, Khasia Hills and Burma, and *T. mysorensis*, T. And. of the Western Ghâts, are large climbers with pendulous racemes of red or yellow flowers, and a soft, very fibrous wood.

2. PETALIDIUM, Nees. *P. barlerioides*, Nees; Fl. Br. Ind. iv. 416, is an ornamental shrub of the West Himalaya, Oudh, Central, Southern and Western India, found in deciduous forests and especially common in the N. Circars.

3. DÆDALACANTHUS, T. Anders., contains several species with ornamental flowers, more or less shrubby and some of them conspicuous in the forest undergrowth of various parts of India. *D. splendens*, T. And.; Fl. Br. Ind. iv. 418; Gamble Darj. List 60; Vern. *Shechin*, Nep., is a red-flowered shrub common in the undergrowth of Sál forests in the Darjeeling Terai and lower hills up to 2000 ft. *D. nervosus*, T. And.; Fl. Br. Ind. iv. 418; Gamble Darj. List 60; Vern. *Shechin*, Nep.; *Topatnyok*, Lepcha, is a small shrub with bright blue flowers conspicuous in the forests of the Lower Himalaya and sub-Himalayan tract from the Punjab to Bhutan, especially frequent in the undergrowth of the Sál forests. *D. macrophyllus*, T. And., is a very similar plant of the forests of Burma; while *D. purpurascens*, T. And., is similarly common in Central India, and *D. montanus*, T. And., in S. India and Ceylon.

4. STENOSIPHONIUM, Nees, contains five small shrubs with blue flowers, very much resembling *Strobilanthes*, and found in the forests of South India.

5. ÆCHMANTHERA, Nees. *Æ. tomentosa*, Nees; Fl. Br. Ind. iv. 428, is a *Strobilanthes*-like shrub of the Himalaya ascending to 5000 ft., and extending from Kashmir to Bhutan. It flowers gregariously and dies off at regular intervals, both in the lower hills and in the Siwaliks. The var. *Wallichii* has the stems and leaves covered with a snow-white wool, which peels off easily and can be used for various purposes. Cloth is said to be sometimes made of it.

6. STROBILANTHES, Blume.

This is a very large genus of some 160 rather important Indian forest shrubs, of which 154 species are described in the "Fl. Br. Ind." The importance lies in their being, at any rate many species of the genus, gregarious in the undergrowth of the forests in the hilly regions of India, and so exercising a considerable influence in the protection or the reverse of the natural reproduction of the trees which form the canopy. It is in the "shola" forests of the Nilgiri and other hill ranges of South India and of the hills of Ceylon that the genus reaches its greatest development; the number of species is greater, most of these species are gregarious over defined areas, and nearly all

of them grow to a comparatively large size, flowering and fruiting, like the bamboos, gregariously, at intervals of a certain number of years. In these South Indian and Ceylon hills, the greatest development of species of *Strobilanthes* occurs in the higher sholas, where the lower tier of vegetation consists very largely of them, associated with various other genera, such as *Psychotria*, *Lasianthus*, *Saprosma* in *Rubiaceæ*, *Crotalaria* in *Leguminosæ*, *Vernonia* in *Compositæ*; but lower down also on the damper slopes and in ravines, certain species are found even down to as low as 3000 ft. Similarly, in the forests of the Western Ghâts running northwards up the Bombay coast, other species occur growing in similar fashion, but perhaps of less size; while in the hills of the Deccan and Circars wherever a certain elevation is reached, as for example on the Mahendragiri Hill in Ganjam, *Strobilanthes* always reappears as an important constituent of the forest undergrowth. In the hills of Burma, too, the same phenomena are seen; while in those of Assam, as well as in the Eastern Himalaya, the genus is again well represented, the individuals, however, never reaching the size or attaining the sylvicultural importance which is reached by those of South India and Ceylon. Further to the north, in the Western Himalaya, *Strobilanthes* becomes again important, a few species becoming densely gregarious, though of quite small size, but exercising a very important effect on the natural reproduction of the principal forest trees. In these hills of the Western Himalaya, two species, *S. alatus*, Nees, and *S. Dalhousianus*, Clarke are common blue-flowered shrubs of the higher forests, flowering yearly and of little sylvicultural importance; but two others, *S. Wallichii*, Nees, and *S. atropurpureus*, Nees (Vern. *Jánu*, *zánu*), are gregarious, often covering large areas in the higher forests above 7000 ft., and only flowering at intervals of several years. The peculiarity of these two closely allied and nearly identical species is that, every year, after the first one or two, the upper shoots die back and fall off, but others shoot up in the spring; meanwhile, the main stems, which form a dense matted covering to the soil, remain and prevent the seeds of the forest trees, chiefly oaks like *Quercus dilatata* and *semecarpifolia*, and firs like *Picea Morinda* and *Abies Pindrow*, from reaching the ground, or if they do reach the ground, obtaining sufficient light for germination and growth. The cycle of flowering of these species has not yet been very clearly made out, but they certainly flowered in 1894 and previously in 1882. After a flowering year, the whole plant dies off and is next year succeeded usually by a profuse crop of seeds. Then it is that the chance of the forest tree arrives: if the oaks or firs can succeed in getting a start during the year or two that the *Strobilanthes* is small, they can go on, otherwise the new growth soon destroys them. In some places artificial assistance is now being regularly given, and when signs of a flowering year appear, the shrub is pulled up or cut and burnt so as to prevent its ripening seed. In this way a great advantage is given to the forest trees, which usually take the opportunity of growing. Lower down in the same hills, come other species, noticeably *S. pentstemonoides*, T. And., but their influence is unimportant. In the Sál forests, and indeed almost wherever there are Sál forests, down even to the Central Provinces and the Circars, *S. auriculatus*, Nees is a noticeable plant. In the hills of the Eastern Himalaya, several species occur, as well as *S. Wallichii*, Nees, *S. pentstemonoides*, T. And., and *S. auriculatus*, Nees, already mentioned. Perhaps the most noticeable are *S. pectinatus*, T. And., and *S. divaricatus*, T. And., the latter with dark purple flowers, but their sylvicultural importance is much less than is that of the species of the Western Himalaya. Referring to *S. pectinatus*, Manson ("Darjeeling Working Plan," 1893, p. 19) says that a dense growth of *Kibu* existed previous to 1890, when it seeded and died. It is a woody plant with stems up to 6 to 8 ft. high and 3 in. in diameter. Seedlings were found under it, especially of Maple and "Kaula," which are now coming on. In the Khasia Hills perhaps the most important species is *S. flaccidifolius*, Nees, a species whose leaves give a kind of indigo for which the plant is also cultivated (Vern. *Room*). *S. isophyllus*, T. And., is also found in the Khasia Hills, and is often cultivated in gardens elsewhere. On the hills of the Northern Circars, such as Mahendragiri in Ganjam and the Golgonda Hills in Vizagapatam, the common species in the sholas is *S. jeyporensis*, Bedd., which grows to be a large shrub. Talbot mentions 11 species as found on the Western Ghâts and outlying hills of the Bombay Presidency. Among those are *S. barbatus*, Nees, a gregarious white-flowered shrub, said to flower once in seven years, and common in the evergreen forests of the Konkan and North Kanara, where, too, are found *S. warreensis*, Dalz., *S. Heyneanus*, Nees, and *S. ixiocephalus*, Benth. Of the common *S. callosus*, Nees, Talbot remarks, "it 'covers large areas on the Konkan and North Kanara Ghâts, and forms the undergrowth 'in many of the deciduous moist forests. Sometimes a very large shrub (30 ft. in

'height and 2¼ in. in diameter.) A general flowering takes place every seven years. 'Last general flowering in Sept.-Oct. 1887." He also mentions *S. perfoliatus*, T. And. as a gregarious species flowering once in seven years, the last being in 1887, on the Konkan and Kanara Ghâts. Finally *S. scrobiculatus*, Dalz., said by C. B. Clarke in "Fl. Br. Ind." to be "the most beautiful species of the genus" is found at Mahabaleshwar and other places on the ghâts at high levels, 3–4000 ft. It is hardly possible to mention all the important species of the hills of S. India, but my account of "The Nilgiri Strobilanthes" in "Ind. Forester," xiv. 153 (of 1888) may be referred to, from which the following extract is taken:—

"The most common and best known species is *S. Kunthianus*, which prefers the 'dry slopes of the eastern side of the hills, where there is little or no tree-forest. In 'such localities it is chiefly found associated with *Rhodomyrtus tomentosa*, *Hypericum* '*mysorense*, *Rubus ellipticus*, *Berberis aristata*, *Dodonæa viscosa*, *Sophora glauca*, and 'the wild date. But when it is in flower, it is the Strobilanthes which gives its colour to 'the scenery, and the hills may often be seen having the bright blue colour which has 'led some persons to attribute to this circumstance the origin of the name of the 'Blue 'mountains.' *S. Kunthianus*, T. And., flowers at intervals of some four to six years. 'It flowered profusely in 1881 and again in 1886, and may be again expected to flower 'about 1891, though sporadic flowering specimens which have not died may here and there 'be met with in most years. On the downs to the west of Ootacamund the *S. Kun-* '*thianus* is replaced by the much smaller *S. sessilis*, Nees, a beautiful plant with flowers 'of a lovely tinge of blue. Almost every year the sholas of Ootacamund become gay in 'autumn with the blue, lilac or white flowers and the reddish young leaves and bracts 'of *S. Perrottetianus*, Nees, while in some sholas *S. foliosus*, T. And., a quite different- 'looking kind, is more common, and grows to a larger size of wood, having often stems 'of 4 to 6 in. in diameter. The chief species on the higher parts of Doddabetta is *S.* '*sexennis*, Nees, which has a powerful and rather unpleasant odour, but when in flower 'shows a mass of bright blue panicles. It flowered last in 1883, and then died down, 'leaving its knotty stems to be used as fuel and myriads of seedlings to form a new crop. 'In 1886 there flowered in the Cairn Hill sholas a species with a curious narrow-necked 'bell-shaped flower, which has been identified as *S. pulneyensis*, Clarke, hitherto only 'known from the Pulney Hills. Another common Ootacamund species is the rough- 'looking *S. Wightianus*, Nees, which grows indiscriminately on grass land or in shola, 'and flowers yearly. About Coonoor, in the Lamb's Rock and Tiger Hill forests, besides '*S. foliosus* and *S. Perrottetianus*, a species is found which Col. Beddome says he 'watched for years without finding flowers. The flowers came in 1886, and the plant 'seems now to be identifiable with *S. heteromallus*, T. And. The species grows to a 'very large size on the Coonoor Ghât, and does not seem to have been gathered in 'flower since Dr. Wight collected it in 1850. As Col. Beddome had, during these thirty- 'six years, such fine opportunities of watching it, it may be that its period of growth is 'so long as thirty-six years, or it may have flowered unnoticed every twelve or every 'eighteen.

"Some of the most beautiful species are those of the Kundahs, and especially at 'Sispara, where in 1883 was found the beautiful but sticky *S. amabilis*, Clarke, with 'its large panicles of pink bells, and the woolly-leaved *S. gossypinus*, T. And., which 'almost alone gregariously covers one large hillside above Sispara. Col. Beddome 'collected his specimens in 1870 and I mine in 1883, so that its term may be thirteen 'years, though a specimen of its wood in the Madras collection shows only ten annual 'rings. About Naduvatam, *S. asper*, Wight, a rough-looking shrub, flowered gregariously 'in 1885, and died off, and in 1883 the same happened at Sispara, with *S. homotropus*, 'Nees, a species closely allied to *S. sexennis*. In the same year was found the species 'which is probably the most beautiful of all, *S. violaceus*, Bedd., only found in a shola 'near Bangi Tappal, where it overshadows a fine growth of the fern *Lomaria Patersoni*. 'The flowers are a deep violet, and so far as is known, it was last gathered by Col. 'Beddome in 1870. This account ought not to close without mention of *S. luridus*, 'Wight, a straggling species of the western forests of Sispara to Naduvatam. It has 'cone-like spikes of large dark purple flowers, of which a white variety occasionally 'occurs, and which grow on the stems on the old wood. It has a near ally in a 'remarkable species which is only found in the valley at the head of the Noyil river in 'Coimbatore, *S. bolamputtensis*, Bedd., a curious species with large serrated orbicular 'bracts and brown flowers."

To those who have to manage, and make working plans for, shola forests in which the undergrowth chiefly consists of *Strobilanthes*, the importance of taking advantage

of seeding years when the shrub dies off, is very great; but the conditions are different from those which have been described as occurring in the Western Himalaya. In the Nilgiri sholas, the shrubs grow tall and tree-seeds easily pass through them, reach the ground and germinate, but the seedlings then remain making very little growth until the *Strobilanthes* dies and light is let in. The best thing to do is to cut the *Strobilanthes* before it flowers and dispose of the material, and also then to thin out the trees of the canopy; this gives the seedlings a chance of which they are usually not slow to avail themselves. This kind of work was started in 1886 (see the paper referred to) with great success, but the Government, somewhat later, stopped it, thinking that the operations spoiled the æsthetic beauty of the sholas.

The species of the Ceylon Hills differ more or less from those of the Nilgiris, but their growth is similar and their habits the same. Several species also occur in Burma, and recently *S. rufescens*, T. And.; Vern. *Moyan*, Shan, has been reported as a gregarious species of considerable importance in its effects on the vegetation of the Upper Chindwin Teak forests in that province ("Ind. Forester," xxi. 47). *S. gregalis*, Coll. and Hemsl.; *Journ. Linn. Soc.* xxviii. 104, is gregarious in the Shan Hills at 4000 ft. on the hillsides, and conspicuous from its dark-coloured leaves. *S. Dyerianus*, Hook. f.; Bot. Mag. liv. t. 7574, is a fine Burmese species allied to the *S. auriculatus*, Nees, of the Northern and Central India Sál forests already mentioned. It has leaves striped pink and green.

Wood whitish, soft to hard. *Pores* small or moderate-sized, scanty. *Medullary rays* fine to moderately broad.

1. **S. foliosus**, T. And.; Fl. Br. Ind. iv. 433.

A large gregarious shrub, apparently flowering annually, with jointed stems and grey *bark*. *Wood* hard, brownish-grey. *Pores* small, often subdivided, scanty; annual rings visible, about 5 per inch. *Medullary rays* numerous, fine and moderately broad.

Nilgiri Hills, 6–7000 ft., very common.

W 4087. Cairn Hill, Ootacamund, 7000 ft. (Gamble).

2. **S. gossypinus**, T. And.; Fl. Br. Ind. iv. 434.

A large gregarious shrub, flowering at intervals of about 10 to 13 years. *Bark* brown. *Wood* light brown, with an irregular heartwood, hard, even-grained. *Pores* small, scanty, more numerous in the spring wood, where they mark the annual rings. *Medullary rays* fine, numerous.

Hills of South India: Mysore; Sispara in Nilgiris at 6–7000 ft.

A local species with cottony leaves and pale blue flowers, growing on open hillsides.

	lbs.
W 3771. Sispara, Nilgiris, 7000 ft. (Gamble)	47

3. **S. pulneyensis**, Clarke; Fl. Br. Ind. iv. 438.

A gregarious shrub, flowering about every 8 years. *Bark* grey, with vertical warts. *Wood* white, hard, close-grained. *Pores* small, often subdivided, scanty. *Medullary rays* fine to moderately broad, numerous.

Nilgiri, Anamalai and Pulney Hills at 6–7000 ft.

W 4086. Cairn Hill, Ootacamund, 6500 ft. (Gamble).

4. **S. papillosus**, T. And.; Fl. Br. Ind. iv. 445.

A large shrub with rough stems and leaves, flowering perhaps annually. *Bark* light grey, smooth. *Wood* pinkish-white, hard, close-grained. *Pores* small, scanty, except in the spring wood, where they mark annual rings.. *Medullary rays* fine, numerous.

Higher ranges of the Nilgiris, 7–8000 ft.

W 3773. Sispara, Nilgiris, 7000 ft. (Gamble).

5. **S. luridus,** Wight; Fl. Br. Ind. iv. 450.

A large straggling gregarious shrub, with twisting interlacing stems and jointed wood, flowering at the joints. *Bark* brown, thin. *Wood* white, moderately hard. *Pores* small, scanty. *Medullary rays* moderately broad, often broad in young wood. *Pith* round, large at the joints.

Nilgiri Hills, 3–5000 ft., common on Sispara Ghát.

W 3810. Sispara Ghát, Nilgiris, 5000 ft. (Gamble).

6. **S. sexennis,** Wight; Fl. Br. Ind. iv. 474; Trimen Fl. Ceyl. iii. 313.

A large gregarious shrub, reaching 4 to 5 in. in diameter in Ceylon, the stems jointed, with a horizontal line at the joints. *Bark* thin, smooth, whitish-grey. *Pores* small, very scanty. *Medullary rays* moderately broad. *Pith* round, large.

Nilgiri Hills, 5–8000 ft.; hills of Ceylon.

A very common kind, both in the Nilgiris and Ceylon. It flowered in 1883, and its period is probably about 11 or 12 years, not 6, as its name indicates.

W 3805. Sispara Ghát, Nilgiris, 6000 ft. (Gamble).

7. **S. violaceus,** Bedd.; Fl. Br. Ind. iv. 476.

A large shrub. *Bark* dark brown, thin, with thin corky lenticels. *Wood* white, soft, even-grained. *Pores* scanty, moderate-sized, more numerous in the spring wood, where they mark the annual rings. *Medullary rays* fine to moderately broad.

Nilgiri Hills, south-west corner, 7–8000 ft.

A handsome species with blue-purple flowers. Its term is about 13 years, as it flowered in 1870 and 1883.

W 3772. Bangi Tappal, Nilgiris, 7500 ft. (Gamble).

8. **S. amabilis,** Clarke; Fl. Br. Ind. iv. 474.

A large shrub, with jointed stems. *Bark* greyish-brown, smooth, thin. *Wood* grey, moderately hard. *Pores* small, often subdivided, scanty. *Medullary rays* fine to moderately broad. *Pith* large, round.

Nilgiri Hills, 4–7000 ft.

The flowers are pink, and flower panicles glutinous. The term is probably about 10 years; it flowered in 1883.

W 3806. Sispara Ghát, Nilgiris, 6000 ft. (Gamble).

7. CALACANTHUS, T. And. *C. Dalzelliana,* T. And.; Fl. Br. Ind. iv. 478; Talbot Bomb. List 157; Vern. *Motayén,* Mar., is a shrub of the Gháts of the Konkan and North Kanara.

8. ACANTHUS, Linn. has two shrubby species. *A. ilicifolius,* Linn.; Fl. Br. Ind. iv. 481; Roxb. Fl. Ind. iii. 32; Kurz For. Fl. ii. 241; Talbot Bomb. List 157; Trimen Fl. Ceyl. iii. 317; Vern. *Hargosa, kentki, hurkut,* Beng.; *Alisi, alchi,* Tel.; *Marandi, moranna,* Mar.; *Kaya,* Burm.; *Ikili,* Cingh., is a common and conspicuous erect gregarious shrub of the tidal forests of India, Burma and Ceylon, with large blue flowers and holly-like leaves. It is useful to bind the mud of tidal river-banks. *A. ebracteatus,* Vahl; Fl. Br. Ind. iv. 481; Kurz For. Fl. ii. 242, is a shrub of the mangrove jungles of the Andamans.

9. BARLERIA, Linn. contains several species, but few of them of any size. *B. Prionitis,* Linn.; Fl. Br. Ind. iv. 482; Roxb. Fl. Ind. iii. 36; Trimen Fl. Ceyl. iii. 318; Vern. *Kanta-jati,* Beng.; *Mulu govinda,* Tel.; *Bidbans korati,* Kurku; *Katu-karandu,* Cingh., is a small yellow-flowered prickly shrub common in Bengal, the Deccan and Carnatic, and the dry country of Ceylon. *B. cristata,* Linn. is a purple-flowered shrub of many parts of India, especially the Lower Himalaya; *B. strigosa,*

Willd. is a blue-flowered shrub of the undergrowth of forests in ravines in most parts of the country. Both these are occasionally to be found in gardens.

10. ERANTHEMUM, Linn. *E. indicum*, Clarke; Fl. Br. Ind. iv. 497; Gamble Darj. List 60, is a shrub with white flowers veined with purple, found in the Eastern Himalaya, Assam and the Khasia Hills, up to 7000 ft. It is not uncommon in the forests round Darjeeling.

11. PHLOGACANTHUS, Nees.

Several species, but only one of them is of any consequence.

1. **P. thyrsiflorus**, Nees; Fl. Br. Ind. iv. 512; Kurz For. Fl. ii. 246; Gamble Darj. List 60. Vern. *Sua, shechin*, Nep.; *Sumcher*, Lepcha; *Bashkah*, Mechi.

A large evergreen shrub. *Bark* grey. *Wood* white, moderately hard, close-grained. *Pores* small, scanty, often in short radial lines. *Medullary rays* numerous, moderately broad and fine.

Sub-Himalayan tract from the Jumna to Assam, Khasia Hills and Burma; often cultivated. A handsome shrub with long spikes of flame-coloured flowers.

		lbs.
E 2410.	Bamunpokri, Darjeeling Terai (Gamble)	37

12. JUSTICIA, Linn. A large genus of small plants, only a few reaching shrubby size. *J. Gendarussa*, Linn. f.; Fl. Br. Ind. iv. 532; Roxb. Fl. Ind. i. 128; Kurz For. Fl. ii. 247; Gamble Darj. List 60; Talbot Bomb. List 158; Trimen Fl. Ceyl. iii. 335; Vern. *Jagat-madan*, Beng.; *Jatrasigi*, Mechi; *Bakas, teo*, Mar.; *Bawanet*, Burm., is a shrub of the beds of streams in the moister regions of India, Burma and Ceylon.

13. ADHATODA, Nees.

Two species. *A. Beddomei*, Clarke; Fl. Br. Ind. iv. 540, is a large shrub of the hills of South Travancore at 3000 ft.

1. **A. Vasica**, Nees; Fl. Br. Ind. iv. 540; Gamble Darj. List 60; Talbot Bomb. List 158; Trimen Fl. Ceyl. iii. 338. *Justicia Adhatoda*, Linn.; Roxb. Fl. Ind. i. 126; Kurz For. Fl. ii. 248. Vern. *Bakas, vasúka*, Beng.; *Bahekar, basúth*, Kashmir; *Bhekkar*, Jhelum; *Basúti*, Beas; *Bekkar*, Salt Range; *Tora bujja*, Trans-Indus; *Bansha*, Sutlej; *Bangsa*, Garhwal; *Bashang arús*, Kumaon; *Kath, alesi*, Nep.; *Arúsa*, Jeypore; *Basung*, Uriya; *Adulsa, bakas, vasuka*, Mar.; *Adhatodai, pavettai*, Tam.; *Addasaram*, Tel.; *Agaladara, wanepala*, Cingh.

A small shrub with white, moderately hard *wood*. *Pores* very small, uniformly distributed. *Medullary rays* fine and very fine, numerous.

Common in the sub-Himalayan tract from Nepal westwards, up to 4000 ft., also the Shan Hills of Burma; elsewhere cultivated; often gregarious.

One of the most common plants in Northern India, found everywhere in waste places, on river-banks, on dry slopes, etc.; and thriving where other vegetation fails because of its immunity from the browsing of goats and other animals. The wood is used for charcoal for making gunpowder (Baden-Powell). The leaves give a yellow dye, but their chief use is as a dressing for rice-fields, as they seem to have the power of killing aquatic weeds, a characteristic which seems to deserve study. An infusion of them is accounted excellent for destroying white ants, flies, mosquitoes and other noxious insects; and they are also used in native medicine.

H 2943. Sutlej Valley, Simla, 3000 ft. (Gamble).

ORDER LXXXII. VERBENACEÆ.

An Order which is of considerable forest importance, if only from the fact of its containing the Teak tree, the principal timber tree of India, indeed, it may be said, of the East Indies generally. Some species of *Gmelina* and *Vitex* are also of more or

less importance, but the rest of the woody plants of the Order are small trees of little note, shrubs and climbers. There are 15 genera, belonging to five Tribes: viz.—

Tribe I. Verbeneæ	Lantana.
„ II. Viticeæ	Callicarpa, Tectona, Premna, Gmelina, Vitex, Clerodendron, Holmskiöldia.
„ III. Caryopterideæ	Caryopteris, Glossocarya, Hymenopyramis.
„ IV. Symphoremeæ	Symphorema, Sphenodesma, Congea.
„ V. Avicennieæ	Avicennia.

In addition to several indigenous plants with handsome flowers herein noticed, there are several others which have been introduced and are grown in Indian gardens. Among these are: *Duranta Plumieri*, L., a large shrub with light blue flowers, frequently used to make hedges; *Petræa volubilis*, L., a climber with violet flowers in a light-blue calyx; and the lemon-scented Verbena, *Aloysia citriodora*, L., which, in the hill-stations of South India, grows into quite a large shrub.

Wood usually of good quality, not liable to warp or split, of various colours. *Pores* usually moderate-sized, scanty, those in the spring-wood larger and marking the annual rings. *Medullary rays* generally fine and moderately broad, regular, with a well-marked silver-grain on a radial section. The wood of *Avicennia* is quite anomalous; and that of the climbing species shows always, more or less, the porous character of the wood of climbers.

Tribe I. VERBENEÆ.

1. LANTANA, Linn. Three indigenous species, the most common of which is *L. indica*, Roxb. Fl. Ind. iii. 89; Fl. Br. Ind. iv. 562; Talbot Bomb. List 159; Trimen Fl. Ceyl. iii. 346 (*L. alba*, Schauer; Brandis For. Fl. 369; Kurz For. Fl. ii. 253) a shrub found more or less all over India. It is unarmed, while the plant which is known as "The Lantana," and which has its branches covered with prickles, is an introduced species, indigenous in tropical America and common in European greenhouses, which is mentioned in the "Fl. Br. Ind." as *L. Camara*, Linn., and by Trimen as *L. aculeata*, Linn. Trimen says it was introduced into Ceylon soon after 1824, and that it spread over the country with extraordinary rapidity. It has spread similarly all over those parts of the Peninsula of India which are suited to its growth, but whether it came across from Ceylon or was deliberately introduced into India before or at the same time as it was into Ceylon, is not recorded, so far as I can ascertain. At any rate, the Lantana now covers, with a dense network of intertwined branches, large areas of country, almost to the complete exclusion of other vegetation. How far this growth is good or bad for the forests of the present and the future has been much discussed, and in some provinces, especially Berar and Coorg, much money has been spent in clearing away the Lantana growth in order to plant, or to allow of the natural reproduction of, forest trees. In 1896, considerable discussion on the subject took place in the "Indian Forester" (vol. xxii.), and the summary of the discussion by Mr. A. E. Lowrie, at p. 385 of that volume, explains that the effect of Lantana is slightly different in (1) Deciduous forest; (2) Evergreen forest. In the former class it is very liable to extremely fierce jungle fires, but if these can be kept off it is a good nurse for forest trees, especially Sandal, and a good soil-maker. When once the trees are through the Lantana, their shade begins to act, and the latter gradually disappears. But on the whole it is necessary to keep down Lantana as much as possible. In the second class, fires are not so liable to occur, and the Lantana growth is better and more manageable than would be the growth of coarse grasses which would have come up instead. In the good surface soil formed by the débris of the Lantana, seeds of forest trees easily germinate and the seedlings steadily force themselves through, so that good reproduction is assisted and ensured. The spread of Lantana is caused by the fruit being edible and largely devoured by birds, who pass the seeds perhaps far away from where the fruit was gathered. Vern. *Raimani*, Berar.

Bark light brown, thin, with small lenticels. *Wood* hard, white.

Annual rings distinctly marked. *Pores* moderate-sized, numerous. *Medullary rays* fine, regular, indistinct.

O 4917. Saharanpur Bot. Garden (Gollan).

TRIBE II. VITICEÆ.

2. CALLICARPA, Linn.

About ten species, shrubs or trees with red flowers and more or less stellately-hairy leaves and branches. *C. lobata*, Clarke; Fl. Br. Ind. iv. 567 is a deciduous tree of the Eastern Nepal Himalaya at 10–11,000 ft. *C. vestita*, Wall.; Fl. Br. Ind. iv. 567; Gamble Darj. List 60; Vern. *Súng-a*, Lepcha, is a small tree of the lower Darjeeling Hills at 1–6000 ft., chiefly found in old cultivated lands and recognized by the soft white tomentum on the leaves. *C. lanata*, Linn.; Fl. Br. Ind. iv. 567; Roxb. Fl. Ind. i. 391; Brandis For. Fl. 368; Bedd. Fl. Sylv. clxxiii.; Talbot Bomb. List 159; Trimen Fl. Ceyl. iii. 350; Vern. *Kan phulia*, Mar.; *Eisur*, *eshwar*, Bombay; *Vettelei patta*, Tam.; *Thin perivelum*, *uma thekka*, Mal.; *Puru*, Trav. Hills; *Illa*, Cingh., is a small tree, common throughout South and West India and Ceylon in hill forests. *C. rubella*, Lindl.; Fl. Br. Ind. iv. 569; Kurz For. Fl. ii. 274; Gamble Darj. List 61; Vern. *Sugroomook*, Lepcha, is a small tree of the Sikkim Himalaya, the Khasia and Jaintia Hills at 2–4000 ft., and the hills of Martaban; while *C. psilocalyx*, Clarke, is also found in the Khasia Hills at 4–5000 ft. *C. longifolia*, Lamk.; Fl. Br. Ind. iv. 570; Roxb. Fl. Ind. i. 394; Brandis For. Fl. 369; Kurz For. Fl. ii. 275, is a shrub of Eastern Bengal, Chittagong and Burma, often also seen in cultivation in Indian gardens.

Wood white or brownish-white, even-grained. *Pores* small to large, usually in radial lines. *Medullary rays* moderately broad to broad.

1. **C. arborea,** Roxb. Fl. Ind. i. 390; Fl. Br. Ind. iv. 567; Brandis For. Fl. 368; Kurz For. Fl. ii. 274; Gamble Darj. List 60. Vern. *Ghiwala*, *dera*, *shiwali*, Kumaon; *Dhaia*, Garhwal; *Bormala*, Beng.; *Goehlo*, Nep.; *Kodo*, *kozo*, Mechi; *Súng-a*, Lepcha; *Doika*, Rajbanshi; *Khoja*, Ass.; *Makanchi*, Gáro; *Boropatri*, *sanu gambari*, Uriya; *Dum kotokoi*, Sonthal; *Sakrela*, Mal Pahari; *Búndún*, Kól; *Bogodi*, *gogdi*, Kharwar; *Borodo*, Khond; *Turmong*, Magh; *Daungsatpya*, Burm.

A moderate-sized tree. *Bark* brownish, rough. *Wood* light brownish-white, moderately hard, even-grained. *Annual rings* marked by a line of harder wood. *Pores* rather scanty, small to large, oval and often elongated, subdivided into numerous compartments, often in radial lines. *Medullary rays* broad, with numerous fine rays between them, well marked on a radial section; the distance between the rays greater than the transverse diameter of the pores.

Sub-Himalayan tract from the Ganges eastwards, ascending to 4000 ft.; Oudh; Rajmehal and Chota Nagpore Hills; Northern Circars; Chittagong and Burma in upper mixed forests: chiefly in second-growth forest and on old cultivated lands, in the Terai in dry mixed forests and savannahs.

Growth fast, 5 rings per inch of radius. Weight: the specimens examined gave 32 to 35 lbs. per cubic foot; Kyd gives only 22 to 25, but there was probably some mistake. The wood is not used except for charcoal. It much resembles the wood of *Gmelina*, also the sapwood of Teak.

	lbs.
E 597. Khookloong Forest, Darjeeling Terai (Manson)	32
E 2397, 2398. Bamunpokri, Darjeeling Terai (Gamble)	35
C 3445. Seemah Reserve, Palamow „	—

2. **C. macrophylla,** Vahl; Fl. Br. Ind. iv. 568; Roxb. Fl. Ind. i. 393; Brandis For. Fl. 368; Kurz For. Fl. ii. 274; Gamble Darj. List 60. Vern. *Pattharman*, *ba-pattra*, *bannu*, Jhelum; *Sumáli*, Chenab; *Deuthar*, *drúss*, Ravi; *Daya*, *birmolo*, *shiwali*, Kumaon; *Indu*, Garhwal; *Dhurwchu*, Dotiál; *Mathara*, *mattranja*, Beng.

A shrub. *Bark* thin, grey-brown. *Wood* white, soft. *Annual rings* marked by a line of close pores. *Pores* moderate-sized, some-

times subdivided. *Medullary rays* moderately broad, the distance between them greater than the transverse diameter of the pores.

Northern India: sub-Himalayan tract and Lower Himalaya, from Hazara eastwards ascending to 6000 ft.; Assam and Upper Burma.

A shrub chiefly of roadsides and waste places, also of old cultivated lands in the damper country, and of ravines, etc., in the dry region. The flowers are pink, the berries white and the leaves densely tomentose.

E 3276. Dainah Reserve, W. Dúars (Gamble).

3. TECTONA, Linn. f.

1. **T. grandis,** Linn. f.; Fl. Br. Ind. iv. 570; Roxb. Fl. Ind. i. 600; Bedd. Fl. Sylv. t. 250; Brandis For. Fl. 354, t. 44; Kurz For. Fl. ii. 259; Gamble Darj. List 61; Talbot Bomb. List 160. The Teak tree. Vern. *Sáj*, Arab.; *Sáj, sál*, Pers.; *Ságun*, Hind.; *Singuru*, Uriya; *Ság, ságwan*, Mar.; *Sipna*, Melghát; *Teka*, Gondi; *Ság*, Bhíl; *Tekku, tek*, Tam.; *Teku*, Tel.; *Jádi, sagwani, téga*, Kan.; *Tekka*, Cingh.; *Kyún*, Burm.; *Djati*, Malay.

A large deciduous tree. *Bark* ⅓ in. thick, light brown or grey, fibrous, with shallow longitudinal cracks, outer bark peeling off in long thin flakes. *Wood* moderately hard, strongly and characteristically scented and containing an oil which is easily perceptible to the touch and is preservative: sapwood white, usually small; heartwood dark golden yellow, turning brown, dark brown and finally almost black with age. *Annual rings* marked by one or more lines of regularly-arranged pores, often set in a belt of loose tissue; in the rest of the wood the *pores* are scattered, scanty, sometimes subdivided, variable in size from small to moderate-sized, a few large. *Medullary rays* moderately broad to broad, fairly numerous, giving a conspicuous handsome silver-grain of elongated plates. *Pith* large, quadrangular.

The Teak tree has two separate regions in the area dealt with in this work—the western or Indian, which is practically the whole of the peninsula of India, and the eastern or Burmese, in the interior of Burma. The Indian region has for its northern limit the rivers Nerbudda and Mahanadi, but here and there it may occasionally be found north of this line, as in Jhansi and Banda, while south of it it scarcely occurs in Orissa or the Circars. It is found in deciduous forest, but is not gregarious; and the localities where the most important forests are found are (1) Chanda District, C.P.; (2) North Kanara; (3) Wynaad, especially the tracts known as Benné and Mudumalai; (4) the Anamalai Hills; (5) Travancore. There are also considerable extents of Teak forest in other parts of the C.P.; in Berar and Bombay; on both sides of the Godavari in Bhadrachalam, Rumpa and Yernagudem; in the Nallamalai Hills of Kurnool and Cuddapah; in South Arcot and in Mysore. But Teak may be found sporadically in places in forests throughout the Indian region, and even in such very dry apparently barren rocky hills as those of Western Kurnool and Bellary, patches of stunted more or less gregarious teak are not uncommon. In the Burmese region, teak is chiefly found in what are called by Kurz the "upper mixed forests" which occupy the parallel ranges of (1) the Arracan Yoma, eastern slope; (2) the Pegu Yoma; and (3) the Martaban Hills and the hills which contain these ranges northwards. The northern limit, according to J. W. Oliver, is about Myitkyina and Kamaing, in lat. 25° 30′, though there it is mostly of stunted growth. Teak has been largely planted about stations all over India, even so far north as Saharanpur, Dehra Dún and Lahore, in avenues and gardens; and forest plantations have been made in many provinces, the chief of which is that at Nilambúr in Malabar, commenced by Mr. Conolly, who was Collector in 1844. In Bengal it has been grown about Kaptai in Chittagong and Bamunpokri in the Darjeeling Terai; and in the Assam Valley there is a plantation as far up as Makúm near Dibrugarh. Outside India, Teak is found in Siam, in the French colonies of Cambodia and Cochin China, and in the Dutch Indies. In the island of Java there are magnificent plantations of considerable area now becoming of great value.

As pointed out by Brandis, "the Teak tree thrives with a mean temperature

'during the cold season of between 60° and 80°, during the hot season between 80° and '85°, during the rains between 77° and 87°, during autumn between 71° and 81°, 'while the mean annual temperature which suits it best lies between 72° and 81°." It grows on various soils, being best on sandstone and metamorphic rocks; but it may be also found on trap, on which it grows well; on laterite, on which, however, it is usually poor; also, occasionally, on limestone; while I have seen almost pure teak forests in black alluvial land on the banks of the Godavari. The most important requirement is good drainage if good straight timber is to be obtained; but it is really a very accommodating tree, and will even stand a certain amount of water-logging, but is then usually stunted and twisted.

Teak is, above all, a light-demanding tree, requiring full light for its head and a free circulation of air. It seeds very freely even when quite young, and the seed germinates well if it gets sufficient warmth and moisture to rot the corky outer covering and enable the hard nut to open. Seed sown in nurseries often takes long to germinate; in my own experience, germination is best if the seeds are simply mixed with sand and dead leaves after being thoroughly soaked, when a certain amount of fermentation probably sets up and germination takes place; but directly this happens the plants must be picked out and put in nurseries or in pots or baskets. As teak has an enormous taproot which resents being cut, it cannot be kept long in nursery, but must be planted out when quite small, and succeeds best when planted out straight into the forest after germination, as is done in "taungyas;" but when this is not feasible, basket or pot plants give good results. In Burma, where teak is most often found associated with bamboos like the *Myinwa*, *Tinwa* and *Kyathaungwa*, over which it forms a kind of upper story, the natural reproduction is good, as indeed it also is in the Indian forests, where it grows mixed with other species of tree and usually much grass, but unless direct light is given overhead the seedlings cannot develop, and die off or remain stunted. As with Sál, Anjan and other trees, teak shoots usually die down yearly; they may be burnt or scorched by the sun, but others shoot up in the rains, again to die down in the next hot season; and this takes place yearly, until finally some year the taproot reaches a good permanently moist stratum, the shoots sent out are stronger and the plant gets a start as a tree. The management of natural teak forests to ensure good reproduction and to increase the proportion of teak compared with other kinds is a difficult matter; but it has been ascertained by experience that great improvement takes place if certain well-defined operations are carried out, and these are prescribed in the Working Plans. They are: (1) Not to girdle isolated trees unless with the object of relieving existing seedlings; (2) to leave sound trees, likely to improve, in localities whence large timber can be extracted; (3) to fell and not girdle trees attacked by epiphytic *Ficus*; (4) to continue taungya plantations with energy, and to weed such plantations regularly; (5) to sow or plant up areas of flowered bamboo; (6) to pay much attention to creeper-cutting. In the Indian teak forests where there is little demand for the timbers of most of the companion trees, there is a tendency for teak, if it alone is cut, to disappear, so that improvement thinnings ought to be taken in hand everywhere in order to relieve the poles and saplings and seedlings of teak and allow them to grow. This will have some effect, but still it will not ensure complete reproduction. In Burma, where bamboo is the chief companion of teak, it is best to take advantage of the periodical flowering and dying off of the latter to try and help the teak to grow; but how best to do this without enormous labour and expense is the problem. Cutting and burning the bamboo *before* its flowering and then planting the land with teak, would perhaps give a good return for the expenditure, because the reproduction of the bamboo would be prevented; but as the teak usually gets ahead of the bamboo seedlings when young, the heavy expense of such an operation can be saved. For many years (since 1856) a system of teak-planting, called taungya-plantation, has been in force in Burma, under which the villagers are allowed to cut and burn certain areas of forest and then to cultivate the land, under agreement to hand it over when done with, with so many good teak plants planted per acre, for which plants they receive payment. The system is cheap and has been a success, and is possibly the best arrangement that can be made for teak reproduction short of regular plantation. The Dutch forest officers in Java have long come to the conclusion that the management of natural teak forests is too difficult and expensive, and they have substituted instead a wholesale system of plantations where the teak can be grown in close forest and regularly treated as a gregarious tree. Some of these plantations are now coming into working, and the results are said to have been excellent, though it may be doubtful whether they will

give as good timber in quality as the natural forests. In July, 1889, there were already about 84,000 acres of plantation, planted at a cost of about £1 per acre ("Ind. Forester," xvii. 448). The plantation is carried out with the assistance of suitable crops, like maize, tobacco, or tapioca (see "Teak Cultivation in Java," by Dr. W. Buurman van Vreden, Inspector-General of Forests in Netherlands India; "Ind. Forester," xviii. 285).

Teak plantations, however, have been largely, perhaps too largely, condemned in India, the large one at Nilambúr being probably the only one of any importance which has been maintained and gradually increased. In Burma, plantations were made formerly at several places, such as Magayee, Kyetpyoogau, Thinganeenoung, Myodwin, etc., but the work has been discontinued. They were started under much the same idea as led to the establishment of those in Java, but are not thought to have given the best results. It is possible that greater success might have been obtained under the Javan system of growing teak with agricultural crops, for teak, like other forest trees, requires cultivation of the soil if its planting is to be really successful. With proper precautions as to transplants, teak is not a difficult tree to grow. Foulkes, in his "Notes on Timber Trees in S. Canara," advises planting a mixture of 50 per cent. Teak, 30 per cent. Jack, and 20 per cent. *Kiralboghi* (*Hopea parviflora*), as the two latter species would not mind being overtopped by the faster-growing teak. But whether it is to be done by plantation or otherwise, it certainly seems desirable that the teak should be more concentrated in growth than it is at present in the natural forests, in order that its sylvicultural treatment may be more easily carried out and extraction and conversion more easily and cheaply carried on. There can be little doubt that, at present, the sylviculture of teak, aiming at natural reproduction only, is not fully understood, and that in the huge forests now under management there are many portions which are not really worth the attempt to work intensively, owing to poorness of soil, unsuitability of climate or other reasons.

In Burma, the system of working adopted under most of the Working Plans is that of "selection girdlings," the number of trees to be girdled over a fixed area being fixed and the girdlings coming round again at regular intervals—every thirty years, for instance. Teak is not felled green, but is girdled standing, so as to kill it, and it is felled and the timber extracted later on. The trees girdled are those which have a diameter of 23 in. in dry, or 27 in. in moist forest. In the Indian region, teak is more usually felled and logged when green entirely on selection. In some localities, where the rest of the forest material is in demand for fuel, the forests are treated in coppice under standard, the standards kept being teak as far as possible. As Brandis says, however, "Timber well girdled dries completely and seasons evenly, for it is on all 'sides freely exposed to sun and wind. Smaller trees dry sufficiently if left standing 'after girdling for one or two years; larger trees must stand longer. When a teak 'tree is felled green, that side of the trunk which is in contact with the ground takes 'a long time to dry, the timber seasons unevenly, it is less useful and less durable, 'and when thrown into the water it does not float readily" ("Garden and Forest," vol. ix.).

The method of treatment determined upon for the teak plantations of Nilambur is that of "high forest with a clean felling of the final crop and artificial regeneration, 'fellings to commence not earlier than the year in which the average girth at breast 'height will be 6½ feet." The final crop on first-class soil is expected to give not less than 40, and on second-class soil not less than 50, trees per acre. The age of exploitability is considered to be 95 years for first-class and 140 years for second-class trees. Thinnings will, of course, be undertaken when necessary ("Nilambur Working Plan," by P. M. Lushington).

It has usually been fully accepted that the well-marked rings which teak wood shows do undoubtedly represent annual layers. But there have been dissentients to this, and reference may be made to "Ind. Forester," iv. 355, and ix. 147, where E. E. Fernandez describes his own experiences, and considers that very often more than one ring may be formed in a year. On the other hand, there is, as stated by J. W. Oliver, in "Ind. Forester," ix. 440, "plenty of evidence to show that the rings of teak trees 'in Burma are annual. Spurious rings undoubtedly do occur, but they are readily 'distinguishable from true annual rings;" and this is my own experience. I have counted rings on stumps and specimens of various trees, for many years, and have found that it is necessary to be very careful, but that with care the spurious rings are capable of recognition and can be neglected. It is possible that the examples cited by Fernandez, of coppice shoots at Punassa, C.P., may have been cases of spurious rings;

at any rate, very young coppice-shoots are not good subjects from which to draw general conclusions. Brandis says: "Subsequent researches have proved that these concentric rings actually represent a year's growth, the dry season being the period of rest 'corresponding to the winter of temperate climates" ("Garden and Forest," vol. ix.).

To my mind, the evidence afforded by the Nilambur specimens cut in 1877 for the Paris Exhibition of 1878, a list of which was given in Ed. 1, p. 284, is conclusive. Out of 29 specimens only one showed more than one ring difference from the expected number, and that one clearly seemed a mistake, an older, perhaps a natural-grown tree, having probably been cut in a particular compartment, a thing which might easily happen. I propose, therefore, to follow Brandis and Oliver, and the many others who have counted rings and obtained data for their Working Plans, in assuming that the rings of teakwood are really annual ones, and represent one year's growth. While on this subject, it is well to refer to S. C.'s remarks in "Ind. Forester," xxiii. 291, on cycles of slow and quick growth, and to mention that the phenomenon is one which naturally must occur in all forests, when the varied conditions under which a tree may spend its long life are taken into account. The rate of growth of teak must, of course, vary considerably according to the locality in which it grows, and the climate, altitude, etc., of that locality. Taking the data obtained in 1878, the Nilambur specimens above referred to, grown in the equable moist hot climate of Malabar, give an average of 2·62 rings per inch of radius; specimens cut from the plantations of South Kanara gave 2·01 rings; and some from plantations in North Kanara gave from 2 to 4·5 rings. The growth in the Bamunpokri plantation, in the sheltered warm climate of the Darjeeling Terai, averaged 2·03 rings; while recently measured plantations at Kulsi in Assam gave 3·6 rings. The Burma plantations of the Tharrawaddy Division showed from 2·6 to 5·8 rings, giving an average for fire-protected forest of 4·33 rings per inch, and of unprotected forest of 4 rings per inch; while plantations in Tenasserim showed a much slower growth, varying from 5·5 at Thinganeenoung to 9·6 in Koloon. On the whole, therefore, plantations in a good climate and on suitable soil may be expected to give a growth of 4 rings per inch of radius, which means a 6-ft. tree at 46 years of age, and an 8-ft. tree at 61 years.

In the natural forest, growth is considerably slower. In his paper in "Ind. Forester," ix. 83, J. W. Oliver gives the result of his measurements in the Mokka-Beeling Reserves in Tharrawaddy—

	rings.
Moist forest with undergrowth of *Tinwa* and *Kyathaungwa* bamboo .	9·13
Very dry forest with undergrowth of *Myinwa* bamboo . . .	14·66

and the average ages of trees in the diameter classes—

	Diam. 12 in.	Diam. 18 in.	Diam. 24 in.	Diam. 30 in.
Moist forest	50	76	105	139
Dry „	44	73	110	167

The data adopted for certain of the Working Plans in Burma are herewith summarized according to girth classes of 3 ft., 4½ ft. and 6 ft., with that of 7 ft., taken as exploitable size.

Working Plan.	Average rate of growth.	Mean age of trees with girth.				Exploitable age adopted.
		3 ft.	4½ ft.	6 ft.	7 ft.	
	Rings per inch.					
Kangyi Forests, Tharrawaddy . .	8	48	60	87	109	—
Shwelè „ Prome . . .	12	75	101	134	158	150
Nawin „ „ . . .	13	70	100	141	170	150
Bondaung „ Toungoo . . .	14·25	80	115	156	185	180
Kabaung „ „ . . .	13·5	73	106	147	177	180
Mohnyin „ Katha . . .	13	60	90	133	166	160
West Swa and Sabyin, Toungoo .	11·75	66	92	125	158	160
Kyaukmasin „ .	15	85	124	165	196	196
Yeni Forest „ .	11·25	60	87	123	146	150
Kadin-Bilin, Tharrawaddy . .	11·5	65	100	125(?)	150	150
Saing, Toungoo	11·75	69	96	126	152	150
Gwethe „	11·5	67	96	127	149	150
Average.	12·2	68	97	132	159	
		29	35	27		

In most of these cases 10 years was allowed for the time taken by a seedling to establish itself; *i.e.* it has been assumed that the seedling is regularly burnt back to the ground for 10 years before it sends up the shoot which eventually grows into a tree (J. W. Oliver).

The most noticeable things about these figures are that the average rate of growth is about 12 rings per inch of radius; and that the average time taken to reach 3 ft. in girth is 68 years, and that after that time a tree takes 29 years to pass to 4½ ft. girth, and thence 35 years to pass to 6 ft., while to pass from 6 ft. to 7 ft. requires 27 years, which means that the growth gets slower as the tree gets older, and this is the experience of most people who have taken measurements in the forest. Mr. S. Carr, writing on this subject, has given recently the following figures: "A teak tree takes '39 years to reach 1½ ft. girth, thence 31 years to reach 3 ft., thence 30 years to reach '4½ ft., thence 37 years to reach 6 ft., and thence 26 years to attain 7 ft. in girth," total 163 years, which is nearly the same result.

Teak, if allowed to grow, and in very favourable places, reaches a very large size. Brandis says, "On the Anamalais, Beddome records trees with a girth of about 22 ft. 'and a straight trunk of some 80 to 90 ft. to the first bough. In the North Kanara 'forests, clear stems 70 to 80 ft. long are not rare; in the Ahiri forests, Col. Pearson 'reports stems 60 to 70 ft. high; and even considerably further north in the Khandésh 'Dangs I have measured clear stems 60 to 70 ft. long to the first branch. Girths of '10 to 15 ft. are not uncommon and numerous instances of 20 to 25 ft. are on record." From Burma S. Carr has reported a log 64 ft. long with 13¾ ft. mean girth; H. Calthrop two trees of 20 ft. girth and 60 ft. to the first branch; C. Muriel a tree 17½ ft. at 5 ft. from the ground; and J. Nisbet a log 82½ ft. long with a mean girth of 10 ft. The number of trees per acre is not usually large, as teak is not a gregarious tree. Brandis mentions 50 acres in the Bimaram Forest, C.P. with 8·3 trees per acre over 4½ ft. girth; also 17 sq. miles in the Prome District of Burma with 6·6 trees over 4½ ft. girth per acre. Corbett's Working Plan of Taungnyo Forest in Tharrawaddy gives an average of sound trees over 1 ft. in diameter per 100 acres of 296; and H. Carter's Working Plan for the Shwelé forests in Prome gives similarly 219. He considers that in such forests teak forms, roughly, nearly one-eighth of the growing stock. In plantations there will be more: Aplin records that in the Thinganeenoung Plantation in 1880 there were 60 trees over 2 ft. in girth per acre, Beddome estimated that at 85 years of age there would be, at Nilambur, 60 trees to the acre with a cubic contents of 16,800 cubic feet. This would mean that each tree would have a radius of spread of 15 ft., which is not much for such large trees, so that the estimate is probably too high. The boles of teak trees are often much and deeply buttressed at base, which may cause some waste of timber in conversion.

The weight and transverse strength have been determined by the following experiments:—

Experiment by whom conducted.	Year.	Wood whence obtained.	Weight.	No. of experiments.	Size of bar.	Value of P.
			lbs.		ft. in. in.	
Wallich . . .	—	Ceylon	47	—	—	—
,, . . .	—	Travancore	42	—	—	—
,, . . .	—	Malabar	37	—	—	—
,, . . .	—	Moulmein	31·5	—	—	—
A. Mendis, No. 85 .	1855	Ceylon	55	—		810
,, No. 86 .	,,	Cochin	44	—	2 ×1 ×1	672
,, No. 87 .	,,	Moulmein	42	—		640
Bennett, No. 12 .	1872	,,	42	3	3 ×1½×1½	747
French (Erode) .	1861	South India	—	3	1 ×1 ×1	467
Cunningham . .	1854	Vindhyan hills	44·5	1	2 ×1 ×1	953
Puckle . . .	1859	Mysore	43	4	2 ×1 ×1	730
Couch (Plymouth) .	—	India	38·5	2	—	—
Simpson . . .	—	Thoungyeen and Zimmee: Good timber girdled	43·5	13	3 ×1½×1½	478
,, . . .	—	Young timber girdled	42	4		660
,, . . .	—	Large timber girdled	38	8		591
,, . . .	—	Dead timber not girdled	39·5	5		631

Experiment by whom conducted.	Year.	Wood whence obtained.	Weight.	No. of experiments.	Size of bar.	Value of P.
			lbs.		ft. in. in.	
Skinner, No. 122	1862	Malabar	45	—	—	814
,,	,,	Moulmein	43	—	—	809
,,	,,	Pegu	37	—	—	736
Fowke	1859	Nagpore	41	4	—	472
Kyd	1831	Burma	38	1	2 ×1 ×1	663
Campbell	1831	,, (unseasoned)	47	4		634
,,	,,	,, ,,	42	2		604
,,	,,	Java	43	1	6 ×2 ×2	693
,,	,,	Bombay	41	2		587
,,	,,	Malabar	48	1		468
Maitland	1862	Burma	41	—	3 ×1½×1½	589–889
Baker	1829	Rangoon (Received at Cossipore, April, 1825)	43	5	6 ×2 ×2	658
,,	,,	Bombay	43	6	,, ,, ,,	652
,,	,,	Pegu	46	3		602
,,	,,	Malabar	45	3		782
,,	,,	Burma (Received at Cossipore, April, 1826)	43	3	5½×2 ×2	756
,,	,,	Malabar	48·5	3		689
,,	,,	Malabar (Received at Cossipore, April, 1827)	46·5	2		683
,,	,,	Bengal	—	12	3 ×1½×1	693
,,	,,	Bengal	—	14	2 ×1 ×1	666
,,	,,	,, very old, taken from a Dutch house at Cossipore	41·5	6	7 ×2 ×2	631
,,	,,	,, ,,	46·5	6	,, ,, ,,	731
Russell	1862	,, ,,	41	3	1½×1 ×1	835
Brandis	1862	Burma (No. 86)	40–51	—	4 ×1 ×1	570–867
,,	1864	,,	40·5	12	6 ×2 ×2	568
,,	,,	,, (Half seasoned)	40	6	6 ×2 ×1½	577
,,	,,	,,	45	10	6 ×2 ×2	584
,,	,,	,,	43	9	6 ×2 ×1½	584
,,	,,	,,	46	20	6 ×2 ×2	598
,,	1865–66	,,	38	4	,, ,, ,,	617
,,	,,	,,	38	9	6 ×2 ×1½	670
,,	,,	,,	40·5	5	3 ×1 ×1	812
,,	,,	,,	38	11	2 ×1 ×1	649
,,	,,	,,	37	17	2 ×1 × ¾	612
Laslett, p. 125	1875	Moulmein, No. 1	48·5	6	7 ×2 ×2	684
,, ,,	,,	,, No. 2	50	6		687
,, p. 126	,,	,,	48·5	6	—	—
Dundas	1877	,,	34	12	10 ×4 ×6	467 (E = 2200)
,,	,,	,,	34	12	2 ×1 ×1	791
Talbot	1885	N. Kanara (girdled wood)	41	1	7 ×2 ×2	577
				7	6 ×2 ×2	501
,,	,,	Ditto (not girdled)	39	7	6 ×2 ×2	607
H. H. O'Connell	1886	Coimbatore	50·5	—	—	α = 0·00987
Molesworth	—	,,	45	—	—	800 E = 5000
Specimens enumerated below	—	Various	44½	25	—	—

The weight may, for practical purposes, be taken approximately at 45 lbs. per cubic foot and the value of P at 600. Molesworth, however, gives W = 50 lbs., P = 800 and E = 5000. Captain J. C. Dundas, V.C., R.E., in his "Report on Experiments made at Lucknow in 1877 and 1878" (Roorkee Professional Papers, 1879, vol. viii. No. 32) in which he gives the weight at 34 lbs. P = 470 and E = 2200 as an average, says that logs as received at Lucknow show a weight of nearly 50 lbs. per cubic foot, but that after being well dried and sawn into scantlings, the weight falls to 34 or 35 lbs. His value for P should be a reliable one, for it is based on experiments made with beams of the large size of 10 ft. × 4 in. × 6 in. When quite fresh, teak hardly floats, but when seasoned it floats easily and the oil in the wood prevents its getting waterlogged, so that there is little loss in this way. The teak from the Burma forests is all brought out by water, and wherever practicable the same agency is used in Western and

Southern India. Much of the first part of the extraction has always, however, to be done by land, and in this the use of elephants is almost indispensable; but various types of extraction-carts drawn by cattle or buffaloes are also in use in different localities. Teak is always brought out either in log or in square, in Burma always in log, and all the Government teak is sent to Rangoon and is there sold at periodical auction sales. The conversion is then carried out in private saw-mills, and the converted timber or timber in logs is sent to India or to Europe for sale or supplied to correspondent firms in the scantling desired. Much of the small slabs and pieces is used up in making shingles for roofing houses. There is one difficulty in the utilization of teak wood, viz. that it is so often unsound at the centre, necessitating scantlings being cut so as to leave the centre out. The unsoundness is due partly to the large soft pith which is easily bored by insects, allowing damp and rot to enter afterwards, and partly, perhaps, to so much of the teak still brought out coming from old over-mature trees.

The exports of teak wood from the forests of Burma reached in 1898–99 (latest available figures) 268,283 tons, valued at Rs.227,49,255: that is, of an average value per ton of nearly Rs.85. Taking the ton as 50 cub. ft., we have a rate per cubic foot of Rs.1..11..2. Most of the export wood goes to the United Kingdom.

Teak is the chief export timber of India and Burma, also the chief building timber of the country. The wood is exported chiefly for shipbuilding, especially for the backing of armour-plates in battleships and for the decks of most vessels, also for the construction of railway-carriages and for the best class of house carpentry, being admirably suited for staircases, balustrades, door- and window-frames and furniture. In India it is used for all purposes of house- and ship-building, for bridges, railway-sleepers, furniture, shingles, etc. It is used for carving, the Burmese carved teak-wood being especially noted, in Burma itself carved "kyaungs," or monasteries, being prominent in almost every village of any importance. The wood is very durable, as is shown by the specimens obtained by Brandis from the old city of Vijiyanagar (Hampi) in the South Deccan, which are still sound and good though probably 500 years old ("Ind. Forester," vii. 260). There are also in the Dehra Collection pieces, now quite black and very hard, from the ancient city of Ujjain in Ajmere, whose age must be very great. The durability is probably due to the large amount of oil contained in the wood. This oil is used medicinally, as a substitute for linseed oil and as a varnish (Kurz), but it would seem that its extraction as an oil is difficult, but as a tar is comparatively easy.

The leaves give a dye, used, according to Kurz, for dyeing silk yellow, olive, etc.; the red colour is easily seen on bruising a young leaf; they are very large and are used as plates, for packing, to make rough umbrellas, and as a thatch for temporary huts. Various parts of the tree, including the wood, are used in native medicine.

An analysis of the ash of teak wood made by R. Romanis, D.Sc., Chemical Examiner, Burma, in April, 1885, gave the following result:—

	Sapwood.	Heartwood.
Potash	1·75	1·51
Soda	2·58	2·82
Lime	7·35	11·80
Magnesia	30·57	21·97
Oxide of iron	2·42	1·79
Phosphoric acid	31·97	27·42
Silicic acid	23·36	32·69
Ash per cent. of wood	0·74	1·00

In 1884 Dr. H. Warth had made an analysis at Dehra Dún the result of which was—

		per cent.
Soluble potassium and sodium compounds	0·13	16·88
Calcium carbonate, phosphate of iron, etc.	0·31	40·26
Magnesium carbonate	0·21	27·28
Silica, etc.	0·12	15·58
Amount of ash in 100 lbs. of steam-dry wood = 116 lbs. air-dry wood	0·77	

which results do not tally very well with those of Dr. Romanis. An analysis was made in 1862 by Professor Abel of the white deposit which is so often found in teak wood with the result—

	per cent.
Lime	34·04
Magnesia	1·86
Ammonia	1·12
Phosphoric acid	43·35
Water and organic matter	19·54
Carbonic acid	0·09

The teak tree has several insect enemies; its value has, however, naturally led to the investigation of them more than was perhaps to be expected in the case of less valuable or important trees. Among COLEOPTERA the following have been reported:—

BUPRESTIDÆ.

Psiloptera fastuosa, Fabr., injuring the trees at Nilambur by boring.

CERAMBICIDÆ.

Pachydissus holosericeus, Fabr., better known as *Cerambyx Vatica* or *Neocerambyx holosericeus*, injuring the trees in the Kulsi plantation, Assam.

Stromatium barbatum, Fabr., ditto, damage very serious, often results in the death of the tree.

Stromatium asperulum, White, ditto.

Ægosoma lacertosum, Pascoe, ditto.

It is noticeable that all those reported have been found in plantations, but probably that is because more individual attention is paid to planted trees than to those in the natural forests. The teak-borers of Burma, if any exist, would seem to be still in need of study. There must be Scolytids or other bark species, at any rate. Among HYMENOPTERA may be mentioned a Cynipid which produces galls on the teak trees in the Melghât, Berar. Among LEPIDOPTERA are many species—

COSSIDÆ.

Cossus cadambe, Moore, does serious injury to teak trees in Travancore by boring the stems. Bourdillon reports that the prevalence of the pest is entirely due to the system of lopping for manure, the moth laying its eggs in the dead part of the snags left on the branches, whence the larvæ bore into the tree.

HEPIALIDÆ—a moth, species uncertain, does damage to teak plantations in Prome District, Burma.

NOCTUIDÆ.

Hyblæa puera, Cramer, does very great harm to teak trees almost throughout India, but especially in Burma. Colonel Bingham says of it, "The larvæ 'appeared in the teak plantations about the 20th May, sometimes in incredible 'numbers. They reappeared year after year, stripping the young teak of 'their leaves almost with the rapidity of locusts, and hanging in thousands 'by webs to the branches of the trees. About the end of May they begin 'to pupate."

PYRALIDÆ.

Paliga damastesalis, Moore—the "teak-leaf roller"—has been reported as defoliating teak forests in Berar, the C.P., and in Burma. The trees which suffer most are those on dry stony hillsides.

It is clear that the subject of the insect enemies of teak still requires much investigation. So, also, does the question of the fungoid enemies, if any exist; at any rate, it is satisfactory that none have been reported up to date.

Teakwood does not appear to suffer much from *Teredo;* but in Burma, as pointed out by Mr. R. S. Troup in Ind. For. xxvii. 492, it is frequently attacked by a mollusk, *Martesia fluminalis*, which makes holes in the outer layers of the wood in logs in the rivers.

		lbs.
C 1408.	Jagmandal Reserve, C.P. (Col. Doveton)	—
C 1409.	Ahiri Reserve, C.P. „	38
C 2933.	Sonawani, Satpura Reserve, C.P.	—
	(Tree planted in 1867, cut down in 1876, 10-in. girth.)	
C 2983.	(White Teak, *Dudhia Sagun*) Jubbulpore, C.P., 1863	41
C 2982.	(Black „ *Telia Sagun* or oil teak) „ „	48
C 2987.	(Stone „ *Pattharee Sagun*) „ „	44

(Black Teak is rather darker-coloured, but otherwise there is no difference in structure, and very little in appearance between these three specimens.)

		lbs.
C 1204.	Khandwa, C.P.	—
C 834.	Bairagarh Reserve, Berar (Drysdale)	46
C 2809.	Melghât, Berar (sapwood) (Brandis)	38
C 3783.	Mojagodo Plantation, Ganjam { (1) 10 years old, 5 in. diam. (2) 9 „ 4 „ }	—
C 3942.	Kunuavaram, Upper Godavari { (1) Coppice shoot, 10 years old, 4½ in. diam. (2) Old "Kumri," 8 „ 2½ „ }	—
C 3953, 4055, 4107.	Upper Godavari Forests	40
C 4064.	Bhadrachalam, Upper Godavari (Gamble)	48
E 1202.	Bamunpokri Plantation, Darjeeling Terai, Bengal	—
	Specimens from compartment I. 1 planted 1868	—
	„ „ „ II. 1 „ 1871	—
	„ „ „ I. 1 „ „	—
	„ „ „ I. 3 b „ 1872	—
E 3290, 3291.	Hoolingamara Block, Sitapahar Plantation, Chittagong, 1873 and 1875 (Chester)	—
E 3386, 3387, 3388.	Rampahar Block, Sitapahar Plantation, Chittagong, 1873 (Chester)	—
D 3974.	Agri-Horticultural Garden, Madras (Steavenson)	52
D 4016, 4021.	Collegal, Coimbatore	52 and 58
W 1217.	North Kanara, Bombay (Barrett)	39
W 730, 753.	South Kanara, Madras (Cherry)	46 and 42
W 1206.	Parappa Plantation, S. Kanara, saplings 5 and 10 years	—
W 2959.	Nilambur Plantation, Malabar (Brandis) (3 saplings cut in 1864, 5, 10 and 20 years; 16, 19 and 25 in. girth.)	—
W 1203.	Nilambur Plantation, Malabar (Series Nos. 1 to 33, aged 33 years to 1 year respectively.)	—
W 3850, 4076.	Mudumalai Forest, Nilgiris, 2000 ft.	48 and 55
W 4100.	Benné Plantation, Nilgiris, 3000 ft., 13 years, 6 in. diam.	55
B 2551.	Burma (Brandis, 1862, No. 86)	44
B 801.	Pegu (Ribbentrop)	40
B 1385.	Thinganneenoung Plantation, Martaban (Tree 54 ft. high, 30 ft. to first branch, planted in 1856.)	34
B 2709.	Tavoy (Wallich, 1828)	42
B 1346.	Andaman Islands (Tree planted at Dhunee Valley, Leaf Creek, Port Blair. Height 44 ft., girth 36 in., about 7 years old when cut in 1877, and shows one spurious annual ring.)	—
	Ceylon Collection (Mendis). Old, Nos. 85, 86, 87; new, Nos. 133, 134, 135. Wood respectively from Ceylon, Cochin and Moulmein	40, 44, 44
	No. 47, Salem Collection, Madras	40
	Nordlinger's Sections, vol. 4 (sapwood only).	

2. T. Hamiltoniana, Wall.; Fl. Br. Ind. iv. 571; Kurz For. Fl. ii. 259. Vern. *Dahat*, Burm.

A deciduous tree. *Wood* light brown, hard, close-grained, with an irregular dark brown heartwood. *Pores* small, often subdivided, rather scanty. *Medullary rays* fine, the distance between them equal to the transverse diameter of the pores. *Annual rings* marked by a continuous white line with somewhat larger pores.

Prome district and Upper Burma, where it is common in the dryer forests of Yamethin, Meiktila, Kyaukse and Mandalay.

Growth moderate, 9 to 10 rings per inch of radius. A good wood, and likely to be useful, but much heavier and harder than teak.

		lbs.
B 3126.	Prome, Burma	64

4. PREMNA, Linn.

About 32 species, trees, shrubs, climbers or perennial herbs, some of but small importance, and all difficult to distinguish. *P. corymbosa*, Rottl. and Willd.; Fl. Br.

Ind. iv. 573; Trimen Fl. Ceyl. iii. 351 (*P. cordifolia*, Bedd. Fl. Sylv. clxxii.); Vern. *Pomanti, pedda narva, nagúm, narara*, Tel., is a large shrub of the Deccan and Carnatic and the dry country of Ceylon: it is common in the Kodúr forests of Cuddapah. *P. coriacea*, Clarke; Fl. Br. Ind. iv. 573; Talbot Bomb. List 160; Vern. *Chambari*, Mar., is a large climber of the Western Gháts. *P. scandens*, Roxb. Fl. Ind. iii. 82; Fl. Br. Ind. iv. 573; Kurz For. Fl. ii. 263; Gamble Darj. List 61; Vern. *Sindri*, Nep.; *Monkakrik*, Lepcha, is a climbing shrub of the sub-Himalayan tract from Nepal eastwards, Eastern Bengal and Martaban. It is very common on the banks of streams in the Darjeeling Terai, making a dense close network of straggling branches. *P. flavescens*, Ham.; Fl. Br. Ind. iv. 578 (*P. mucronata*, Roxb.; Gamble Darj. List 61); Vern. *Kalá bogoti*, Nep., is a small tree of the Lower Sikkim Hills up to 3000 ft., Assam and Eastern Bengal. *P. barbata*, Wall.; Fl. Br. Ind. iv. 579; Brandis For. Fl. 367; Gamble Darj. List 61; Vern. *Ganhila*, Punjab; *Lamenar*, Hind.; *Bakar, bakarcha*, Dehra Dún; *Michapnok*, Lepcha, is a shrub or small tree of the Lower Himalaya from the Jhelum to Assam, ascending to 5000 ft. It is not uncommon in the Dehra Dún, especially about Rajpur and in the Lower Jumna Valley; also in the Darjeeling Terai and lower hills. *P. herbacea*, Roxb. and *P. nana*, Coll. and Hemsl., are small herbaceous plants with rosettes of leaves flat on the ground and small whitish flowers, the fruit of which is found in Sál and other dry forests and grass lands. The latter species is found in the Shan Hills, the former almost throughout India, being remarkable as another instance of a dwarf plant in an otherwise woody genus, just as are similar plants in *Erythrina*, *Careya*, *Ochna*, *Grewia* and *Combretum*.

Wood light brown or grey, often streaked, moderately hard. *Pores* small or moderate-sized, rather scanty, often subdivided. *Medullary rays* fine or moderately broad, with a silver-grain of very small plates.

1. **P. interrupta**, Wall.; Fl. Br. Ind. iv. 572; Brandis For. Fl. 367; Gamble Darj. List 61.

A large climbing shrub. *Wood* soft, white, porous, with the structure of a climber. *Pores* large. *Medullary rays* uniform, moderately broad, the distance between them usually equal to the diameter of the pores.

Himalaya from Kumaon to Bhutan at 5–8000 ft.

Brandis calls this a small tree; my specimen was taken from a climber, such as are all I ever saw in Darjeeling. Clarke thinks it may be both. It climbs, as also does *P. bracteata*, Wall., over large trees in the hill forests of Darjeeling. Haines, in Manson's "Darjeeling Working Plan," 1893, calls it a "deciduous-leaved large climber, 'which should be cut." Brandis quotes Wallich as giving the weight at 43 lbs. per cubic foot, which is that of a tree, not a climber. He also says it gives a purple gum.

E 3395. Darjeeling, 7000 ft. (Gamble).

2. **P. integrifolia**, Linn.; Fl. Br. Ind. iv. 574; Talbot Bomb. List 160. *P. spinosa*, Roxb. Fl. Ind. iii. 77. *P. serratifolia*, Linn.; Bedd. Fl. Sylv. clxxii.; Kurz For. Fl. ii. 262; Trimen Fl. Ceyl. iii. 352. Vern. *Ustabunda*, Hind.; *Ganniári*, Beng.; *Kharanarval, aran*, Mar.; *Midi*, Cingh.; *Taungtangyi*, Burm.

A small tree with thorny stems and branches. *Bark* thin, pale. *Wood* light creamy-brown, moderately hard, even-grained, pleasantly scented. *Pores* moderate-sized, sometimes subdivided, numerous. *Medullary rays* fine, close, fairly numerous.

Coast forests of Western and Southern India, Burma, the Andaman Islands and Ceylon.

Of the two specimens (4929 and 4930) received from W. A. Hearsey through F. B. Manson, Conservator of Forests in Tenasserim, the former is, I think, undoubtedly correct. It was obtained in the tidal forests of Tavoy. The second has a similar wood, even more strongly scented, but the leaves differ slightly and the specimen was obtained in the Tavoy Hills. The scent of the wood is pleasant, fresh and fragrant, not so aromatic as sandal. The wood, if it retains its scent, should prove valuable.

		lbs.
B 4929.	Tidal Forests, Tavoy (W. A. Hearsey)	—
B 4930.	Hill " " "	—
B 4923.	Lower Tenasserim "	50

3. **P. tomentosa,** Willd.; Fl. Br. Ind. iv. 576; Roxb. Fl. Ind. iii. 76; Bedd. Fl. Sylv. t. 251; Brandis For. Fl. 367; Trimen Fl. Ceyl. iii. 352. Vern. *Kotokoi,* Sonthal; *Chambara,* Mar.; *Nagal, naoru, naura,* Tel.; *Ije,* Kan.; *Kampu gumadu,* Reddi; *Kolukkatti,* Tam.; *Bu-séru,* Cingh.

A moderate-sized deciduous tree. *Bark* light greyish-brown, like that of teak. *Wood* light brown, smooth, close-grained. *Pores* small or moderate-sized, numerous, often subdivided, in transverse patches surrounded by loose tissue. *Medullary rays* numerous, fine to moderately broad, marked on a radial section as a minute shining silver-grain.

Rajmehal Hills and Chota Nagpore; Orissa and the Circars; Deccan and Carnatic; low country of Ceylon up to 4000 ft.

A common Deccan tree with a useful wood, but very little used. It would be suitable for turning, carving and fancy work.

		lbs.
D 3869.	Horsleykonda, Cuddapah, 4000 ft. (Gamble)	60

4. **P. pyramidata,** Wall.; Fl. Br. Ind. iv. 576. *P. tomentosa,* Kurz For. Fl. ii. 260. Vern. *Kyunbo, kyunnalin, nathabyu,* Burm.

A deciduous tree. *Bark* light greyish-brown. *Wood* very light brown or yellowish-white, often streaked, hard, close-grained, smooth. *Pores* small or moderate-sized, sometimes subdivided, fairly numerous. *Medullary rays* fine to moderately broad, numerous, close.

Burma, throughout the country in the dry and upper mixed forests up to 2000 ft.

Growth rather fast, 4 to 8 rings per inch of radius. Brandis' Burma List, 1862, No. 85, gives W = 52 lbs.; and his four experiments in 1864 gave, with bars 3′ × 1″ × 1″, W = 43 lbs., P = 670; the specimens examined vary from 40 to 54 lbs. The wood seasons well, polishes well, and is used for weaving-shuttles. It would, as also that of other Premnas, do for bobbins. It would also do for turnery, toys and carving.

		lbs.
B 317.	(1867)	54
B 2718.	Tavoy (Wallich, 1828)	53
B 2548.	Burma (Brandis, 1862, No. 85)	51
B 4922.	Burma (F. B. Manson)	47
B 1424.	Burma	40

This latter specimen is rougher, greyer and lighter than the others.

Nordlinger's Sections, vol. 4 (Tab. XI. 5).

5. **P. bengalensis,** Clarke; Fl. Br. Ind. iv. 577; Gamble Darj. List 61. Vern. *Gwyheli,* Nep.; *Sungna,* Lepcha; *Dhaoli,* Mechi; *Gohora,* Ass.

An evergreen tree with indented stem. *Bark* thin, pale, whitish-brown. *Wood* light brownish-white or cream-coloured, smooth, like that of *Gmelina arborea,* hard, even-grained. *Annual rings* well marked by a dark line formed by fewer pores in the autumn wood. *Pores* small to moderate-sized, rather scanty, making a conspicuous satiny silver-grain on a radial section. *Medullary rays* fine, numerous.

Sub-Himalayan tract from Nepal eastwards; Assam and Cachar; Bengal plain, usually on river-banks.

S. E. Peal (*Ind. Tea Gaz.*) says the wood is durable and is a good one to use for the posts of native houses; when old it is used for bridge-work, as it lasts well in water. It would do for turnery and carvings. The growth is fast, 3 to 5 rings per inch of radius.

		lbs.
E 2400.	Sivoke, Darjeeling Terai (Gamble)	47
E 1267.	Lakhimpur, Assam (G. Mann)	50

6. **P. latifolia,** Roxb. Fl. Ind. iii. 76; Fl. Br. Ind. iv. 577; Bedd. Fl. Sylv. clxxii.; Gamble Darj. List 61; Trimen Fl. Ceyl. iii. 353. *P. viburnoides,* Wall.; Kurz For. Fl. ii. 261. *P. mucronata,* Roxb. Fl. Ind. iii. 635; Brandis For. Fl. 366. Vern. *Bankar, gián,* Punjab; *Bakar, bakarcha, basóta, agniún, tumari, jhatela,* Hind.;

Agniú, Kumaon; *Gineri*, Nep.; *Michapgong*, Lepcha; *Dauli*, Rajbanshi; *Pedda-nalla-kura*, Tel.; *Gondhona*, Uriya; *Pachumallai*, Tam.; *Maha-midi*, Cingh.

A small deciduous tree. *Bark* greyish-white, thin. *Wood* light grey streaked with yellow, purple, or faint green, moderately hard, smooth. *Annual rings* marked by a faint line and fewer pores in the autumn wood. *Pores* small and moderate-sized, often subdivided, scanty. *Medullary rays* numerous, uniform, equidistant, moderately broad.

The type is found in Bengal and the Circars, from the Ganges at Rajmehal to Madras; var. *cuneata* (*P. viburnoides*, Kurz) in Burma; var. *mucronata*, in the sub-Himalayan tract from the Chenab to Bhutan, the Khasia Hills and Eastern Bengal.

I have adhered to Fl. Br. Ind. here, but it seems to me that *P. mucronata*, to which all the specimens probably belong, is a distinct species from the South Indian plant. The wood is said to be used in Sikkim and elsewhere to obtain fire by friction. Beddome says the leaves are eaten in curries and used as cattle-fodder.

	lbs.
O 3091, 3092. Kheri, Oudh; O 3082. Gonda, Oudh	35
E 621. Rakti Forest, Darjeeling Terai (Bonham Carter) . . .	38
E 2399. Bamunpokri " " (Gamble)	43

C 3578, from the Khurdha Forests, Orissa (Gamble), appears to be *P. latifolia* type. Vern. *Agabathu*, Uriya.

O 4752, collected by myself in the Saharanpur Siwaliks at Kasumri, near which it is abundant, is the wood of a small or moderate-sized tree with thin greyish-white, smooth bark, and thorny stem and branches. It is apparently the same tree as that seen in the Darjeeling Terai (*P. integrifolia*, Linn.; Gamble Darj. List 61), and referred to by Clarke in Fl. Br. Ind. iv. 574. The specimens dry green, not black, but otherwise resemble those of *P. latifolia*, var. *mucronata*. The wood resembles that of that species, but is somewhat rougher and weighs 39 lbs. per cubic foot.

5. GMELINA, Linn.

Five species. *G. oblongifolia*, Roxb. Fl. Ind. iii. 83; Fl. Br. Ind. iv. 582, is a tall timber tree whose existence is so far only known from Roxburgh's description and figure. It is said to grow in Eastern Bengal, and should be searched for by those who can explore the forests of Sylhet Cachar and Tippera. *G. villosa*, Roxb. Fl. Ind. iii. 86; Fl. Br. Ind. iv. 582 (*G. asiatica*, Kurz For. Fl. ii. 265), is a small tree found along streams in the Sittang valley swamp forests, near Rangoon and in the Nicobars.

An Australian species, *G. Leichhardtii*, F. von Muell., known as "White Beech," grows to a large size and gives a valuable wood, soft but durable and excellent for carving (J. H. Maiden).

1. **G. arborea**, Roxb. Fl. Ind. iii. 84; Fl. Br. Ind. iv. 581; Bedd. Fl. Sylv. t. 253; Brandis For. Fl. 364; Kurz For. Fl. ii. 264; Gamble Darj. List 62; Talbot Bomb. List 161; Trimen Fl. Ceyl. iii. 355. Vern. *Gumhár, khammaru, kambhar, kúmár, gambari, sewan, shewan*, Hind.; *Gúmár, gúmbar*, Beng.; *Kambar*, Oudh; *Kumara*, Garhwal; *Khammara, batinj*, Kumaon; *Sewan*, Merwara; *Gaminea*, Jeypore; *Gambari*, Nep., Uriya; *Gomari*, Ass.; *Numbor*, Lepcha; *Gumai*, Cachar; *Bolkobak*, Gáro; *Kasamar*, Kól, Sonthal; *Gumadi, cummi*, Tam.; *Gúmar-tek, peddagomru, tagumúda, gumudu*, Tel.; *Shivani, kuli*, Kan.; *Shewan*, Mar.; *Chimman, sag*, Bhíl; *Gamberi*, Khond; *Peddu gumu*, Reddi; *Kumbulu, kumbil*, Mal.; *Kurse*, Gondi; *Kássamar*, Kurku; *Kumala*, Trav. Hills; *Et-demata*, Cingh.; *Ramani*, Magh; *Yamane*, Burm.

A moderate-sized or large deciduous tree. *Bark* ¼ in. thick, smooth, white or whitish-grey. *Wood* yellowish, greyish, or reddish-white, with a glossy lustre, even-grained, soft, light and strong, durable, does not warp or crack. *Annual rings* marked either by a white line or by more numerous pores in the spring wood. *Pores* large and moderate-sized, often subdivided, rather prominent on a

vertical section; sometimes arranged in rough, more or less concentric lines. *Medullary rays* short, moderately broad, prominent, visible in the silver-grain as irregular horizontal bands.

Throughout India from the sub-Himalayan tract of the Chenab eastwards and southwards, usually in deciduous forests; all over Burma; moist region of Ceylon up to 5000 ft.

This handsome and useful tree is to be found throughout India, except in very dry localities, but is never gregarious and nowhere very common. In the Lower Himalaya and sub-Himalaya it is met with in the moister parts of the Sál and mixed forests, and in similar places in the C.P., Berar, Bombay and South India. It is most common in Eastern Bengal and Chittagong, and also in Burma. It is often planted as a garden tree and in avenues, and seedlings grow very fast in suitable soil. It coppices very well. It has large yellow flowers and a large fleshy drupe.

Growth fast, our specimens show about 4 rings per inch of radius; a small round in the Bengal Forest Museum shows 10 rings for a mean diameter of 10½ in. or rather less than 2 rings per inch of radius; another shows 27 rings with a diameter of 14 in. or nearly 4 rings per inch. The weight and transverse strength have been determined by the following experiments:—

Experiment by whom made.	Year.	Wood whence procured.	Weight.	Number of experiments.	Size of bar.	Value of P.
			lbs.		ft. in. in.	
Wallich	—	India	32	—	—	—
Kyd.	1831	Assam	38	—	2 × 1 × 1	675
Baker	1829	Bengal	29	3	7 × 2 × 2	375
"	"	"	28	4	6 × 2 × 2	398
"	"	Junagarh	50? wet	4	7 × 2 × 2	324
Brandis, No. 87 . . .	1862	Burma	35	—	—	—
Bourdillon	1886	Travancore	35	—	—	523

The average of specimens enumerated below gives W = 36 lbs., which is probably a fair average.

The wood is easily worked and readily takes paint or varnish; it is very durable under water. It is highly esteemed for planking, furniture, door-panels, carriages and palanquins, and for well-work, boats, toys, packing-cases and all ornamental work (Brandis); it is used in Burma for carving images and canoes. It would probably be a valuable wood for tea-boxes. It is the chief furniture wood of Chittagong and is in some demand in Calcutta, where it has been used for making the show-cases of the Imperial Museum. It has also been used on the Bengal North-Western Railway for the linings of railway-carriages (H. Bell). Writing in May, 1829, in "Gleanings in Science," Captain Baker, the Superintendent of Suspension Chain Bridges, spoke of *Gumbhar* wood as "well calculated for light planking, panelling, blinds and venetians, 'and of much estimation for picture-frames, organ-pipes, sounding-boards and other 'such work where shrinkage is to be avoided," so that it has evidently been long known in the Calcutta market. Indeed, this is obvious, for Roxburgh, writing a century ago, spoke of its value, especially for sluice-valves in brackish water. It is one of the chief woods used to make drums or "tomtoms." The fruit is eaten by Gonds, and, as well as the bark and root, is used in native medicine.

The leaves are sometimes used to feed the "Eri" silkworm of Assam, when castor-oil or *Heteropanax* leaves are not available (Stack).

It does not appear to be much subject to insect attacks, still it has been reported as damaged at Poona by the Chrysomelid beetle, *Calopepla leayana*, Latr., which cuts holes in the leaves. Deer are apparently very fond of it and eat it down regularly.

		lbs.
O 325.	**Garhwal (1868) . . . .**	**33**
O 4488.	**Forest School Park, Dehra Dún, *cult.* (Babu Birbal) . . . .**	**34**
O 343.	**Gorakhpúr (1868) . . . .**	**32**
O 1372.	**Gonda; O 1457. Bahraich; O 1483. Kheri, Oudh .**	**40, 38, 39**
C 182.	**Mandla, C.P. (1870) . . . .**	**35**
C 1129.	**Ahiri Reserve, C.P. (R. Thompson) . . . . . .**	**—**

		lbs.
C 835.	Bairagarh Reserve, Berar (Drysdale)	45
C 2775.	Melghát, Berar (Brandis)	38
C 959.	Guzerát, Bombay (Shuttleworth)	34
C 3549.	Khurdha Forests, Orissa (Gamble)	37
E 676.	Bamunpokri, Darjeeling Terai (Manson)	41
E 2395.	Sivoke Forest " " (Gamble)	35
E 3605, 3620.	Darjeeling Terai	—
E 948.	Eastern Dúars, Assam	36
E 2193.	Nowgong; E 2303. Kamrúp, Assam (Mann)	39, 37
E 1433.	Assam	31
E 1390, 3693.	Chittagong Hill Tracts (Chester)	33
B 295.	Burma (1867)	28
B 1425.	Tharrawaddy, Burma	35

No. 30, new Ceylon Collection (Mendis).
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2. G. asiatica, Linn.; Fl. Br. Ind. iv. 582; Roxb. Fl. Ind. iii. 87; Bedd. Fl. Sylv. clxxii.; Brandis For. Fl. 365; Talbot Bomb. List 161; Trimen Fl. Ceyl. iii. 355. Vern. *Gumadi*, Tel.; *Kumil*, *neelacomul*, Tam.; *Demata*, Cingh.

A large straggling shrub, sometimes climbing, spinescent. *Bark* brownish-white, thin. *Wood* hard, grey. *Pores* moderate-sized, scanty, in groups or short concentric lines. *Medullary rays* fine, short, regular, not numerous.

South India in the Circars, Deccan and Carnatic; low country of Ceylon up to 2000 ft.; elsewhere planted.

A shrub with bright yellow flowers. The wood is used for fuel and is said to make good fences. It is used for churning-sticks (Sir W. Elliot). The root is used in medicine and the leaves are said to have the property of thickening water, rendering it mucilaginous.

C 4336. Juddengi Forests, Godavari (Gamble).

O 4562, 41 lbs., from the Saharanpur Botanic Garden (Gollan), is the wood of *G. Hystrix*, Schult. (see *Hook. Bot. Mag.*, t. 7391), a garden shrub. The *wood* is yellowish-white, hard. *Pores* small, single or in irregular patches. *Medullary rays* fine, numerous.

6. VITEX, Linn.

About 14 species of this genus occur in India, including *V. Agnus-castus*, Linn., which is a common gregarious shrub on the hills of Baluchistan. *V. trifolia*, Linn. f.; Fl. Br. Ind. iv. 583; Roxb. Fl. Ind. iii. 69; Bedd. Fl. Sylv. clxxii.; Brandis For. Fl. 370; Talbot Bomb. List 161; Trimen Fl. Ceyl. iii. 356 (*V. Agnus-castus*, Linn.; Kurz For. Fl. ii. 269); Vern. *Nishinda*, *nirgunda*, Hind.; *Indrani*, *lingúr*, Mar.; *Nir-nochi*, Tam.; *Vavili*, Tel.; *Karanuchi*, Kan.; *Kyaukpan*, Burm., is a shrub or small tree of Bengal, South India and Burma. It is very like *V. Agnus-castus*, and still more like the much more common *V. Negundo*. Clarke says it is "commoner than supposed, 'being frequently unnoticed from its close general resemblance" to the latter, but although my experience has extended over a considerable area, and I have constantly looked for it, I have only really found it in Burma. *V. heterophylla*, Roxb. Fl. Ind. iii. 75; Fl. Br. Ind. iv. 585; Kurz For. Fl. 270; Gamble Darj. List 62; Vern. *Neri*, Nep.; *Murkut*, Lepcha, is a tree of the Eastern Himalaya up to 4000 ft., Assam, Eastern Bengal, Chittagong and Burma, said to have an excellent timber. *V. diversifolia*, Kurz and *V. Wimberleyi*, Kurz are trees of the Andaman Islands. *V. alata*, Heyne; Fl. Br. Ind. iv. 584, is a species of South India, with leaves having winged petioles.

Wood grey, brown or olive-brown, moderately hard to hard. *Pores* small or moderate-sized. *Medullary rays* fine to moderately broad.

1. V. Negundo, Linn.; Fl. Br. Ind. iv. 583; Roxb. Fl. Ind. iii. 70; Bedd. Fl. Sylv. clxxi.; Brandis For. Fl. 369; Gamble Darj. List 62; Talbot Bomb. List 161; Trimen Fl. Ceyl. iii. 357. Vern. *Marwan*, *moráun*, *máura*, *mora*, *wana*, *banna*, *torban*,

shembadu, banni, biuna, Pb.; *Shiwari, shawáli, nengar, mewri, nisinda*, Hind.; *Sonái*, Jaunsar; *Shiwalu*, Dehra Dún; *Shiáli*, Kumaon; *Chattimála, wallá*, Saharanpur; *Pajpati*, Nep.; *Beygúna*, Uriya; *Nirgunda, nengar, nirgúr*, Mar.; *Nirgiri*, Gondi; *Nirgudi*, Kurku; *Samalu*, Berar; *Sindwari*, Sonthal; *Ehúri*, Kól; *Sindwar*, Kharwar; *Vail*, Koya; *Vellei-nuchi, vennochchi*, Tam.; *Veyala, vavili, vamatyakku*, Tel.; *Lakki, lekkigidda, shirnboli*, Kan.; *Nika, nil nika, sudu nika*, Cingh.

A deciduous shrub. *Bark* thin, grey. *Wood* greyish-white, hard. *Annual rings* marked by a narrow belt of numerous pores at the inner edge; in the rest of the wood the *pores* small and moderate-sized, scanty. *Medullary rays* numerous fine, uniform, equidistant.

Common in the drier parts of India, and ascending to 5000 ft. in the West Himalaya; low country of Ceylon.

One of the commonest of Indian plants, especially in hedges, on waste lands round villages, on the banks of streams and on roadsides, rare in the forests. Baden-Powell draws attention to it as an important plant for reboisement work, as it grows easily from cuttings. It is apparently little or not eaten by cattle. The branches are apt to be attacked by dodder (*Cuscuta reflexa*). Graham-Anderson says it is used in Mysore in native ceremonies, especially at funerals; and the leaves are employed to pack over stored grain in order to keep off insects. Growth moderate, 7 rings per inch of radius. Weight 41 to 42 lbs. per cubic foot. The branches are used for wattle-work, hedges and making rough baskets; the root is employed as a febrifuge, and the leaves, root and fruit in native medicine.

		lbs.
H 3044.	Kumharsen, Sutlej Valley (Gamble)	42
O 4651.	Barkala, Saharanpur Siwaliks "	41
C 2789.	Melghát, Berar (Brandis)	41

2. V. altissima, Linn. f.; Fl. Br. Ind. iv. 584; Roxb. Fl. Ind. iii. 71; Bedd. Fl. Sylv. t. 252; Brandis For. Fl. 370; Talbot Bomb. List 161; Trimen Fl. Ceyl. iii. 357. Vern. *Nemili-adagu*, Tel.; *Maila, mayila, kadamanakku*, Tam.; *Myrole, mairol, halgay, nauladi, sampaga-pala*, Kan.; *Banalgay*, Mar.; *Mayilella*, Mal.; *Milla, miyan-milla, sapu-milla*, Cingh.

A large tree. *Bark* ⅓ in. thick, yellowish-grey, fibrous. *Wood* grey with a tinge of olive-brown, hard, close-grained, polishes well. *Annual rings* distinctly marked by a belt of firmer wood on the outer edge. *Pores* small, scanty. *Medullary rays* fine, numerous, wavy.

South and Western India and Ceylon.

An important forest tree in the Deccan Districts, where it is one of those most in demand, and where in forests worked under the permit system, it is usually in a high class among the reserved trees. Beddome says the wood is much in use for building, construction of carts and other purposes. It is also much esteemed in Ceylon, where it occasionally reaches 18 ft. in girth.

The following are the results of the mechanical tests made by Professor W. C. Unwin, F.R.S., for the Imperial Institute (*Imp. Inst. Journ.*, vol. v., May, 1899).

Weight per cubic foot	61 lbs.
Resistance to shearing along the fibres . .	1004 lbs. per square inch.
Crushing stress	3·118 tons per square inch.
Coefficient of transverse strength . . .	6·588 " "
Coefficient of elasticity	721·1 " "

Growth moderate, 8 to 9 rings per inch of radius. Weight 50 to 53 lbs. per cubic foot (South Kanara specimens); 49 and 56 lbs. (Adrian Mendis' Ceylon specimens); Skinner, No. 145, gives 63 lbs. for Kanara specimens. A. Mendis gives P = 788, Skinner P = 557. Molesworth in "Graphic Diagrams for Strength of Teak Beams" gives: Weight 56 lbs., P = 722, E = 4700. Bourdillon gives W = 60 lbs., P = 784. Foulkes says the wood is especially good for use under water.

		lbs.
D 3933.	Cuddapah Forests (Higgens)	56
W 724, 757.	South Kanara (Cherry)	53 and 50

Nos. 54 (56 lbs.) and 78 (49 lbs.), Ceylon Collection (old); Nos. 94 and 124 (new).

3. **V. limonifolia,** Wall.; Fl. Br. Ind. iv. 584; Kurz For. Fl. ii. 271.

A deciduous tree. *Bark* greyish-white, soft, peeling off in thin, somewhat papery, flakes. *Wood* grey, moderately hard. *Pores* moderate-sized, scanty, sometimes subdivided. *Medullary rays* fine, fairly regular.

Eng and dry forests in Burma.

		lbs.
B 5019.	Tharrawaddy Division, Burma	44

4. **V. canescens,** Kurz For. Fl. ii. 270; Fl. Br. Ind. iv. 586.

A deciduous tree. *Bark* greyish-white, smooth. *Wood* light-brown, soft, even-grained. *Pores* moderate-sized, scanty, often subdivided. *Medullary rays* moderately broad to broad, regular.

Assam; Burma, in dry forests.

		lbs.
B 5023.	Tharrawaddy Division, Burma	42

5. **V. pubescens,** Vahl.; Fl. Br. Ind. iv. 585; Bedd. Fl. Sylv. clxxi.; Kurz For. Fl. ii. 271. *V. arborea*, Roxb. Fl. Ind. iii. 73. Vern. *Dhalasingha, muria*, Uriya; *Nowli eragu, nemili adugu, búsi*, Tel.; *Myladi*, Tam.; *Kyetyo*, Burm.

A large tree. *Wood* smooth, reddish-brown or olive-brown, very hard, close-grained. *Annual rings* marked by a more or less sharp line and by a broad belt of firmer wood on the outer edge. *Pores* small to moderate-sized, scanty, uniformly distributed. *Medullary rays* fine and very fine, numerous, equidistant.

Forests of Orissa, the Circars, Deccan and Carnatic; Burma and the Andaman Islands, in upper mixed forests.

This is a fine tree with apparently a better timber than *V. altissima*. Growth moderate, 8 to 10 rings per cubic foot. Weight, according to Brandis' Burma List of 1862, No. 83, 45 lbs., but his specimen weighs 51 lbs.; the specimens examined average 54 lbs. The wood is durable and is used for various purposes in South India.

		lbs.
C 3550.	Khurdha Forests, Orissa (Gamble)	52
D 1058.	South Arcot, Madras (Beddome)	51
D 1063.	Cuddapah " "	59
B 1429.	Tharrawaddy, Burma (Brandis)	56
B 2550.	Burma (Brandis, 1862)	51

6. **V. peduncularis,** Wall.; Fl. Br. Ind. iv. 587. *V. alata*, Roxb. Fl. Ind. iii. 72; Kurz For. Fl. ii. 272. *V. alata*, Heyne; Gamble Darj. List 62. Vern. *Osai*, Ass.; *Boruna, goda*, Beng.; *Mara kata, bhadur*, Sonthal; *Dumraj*, Mai Pahari; *Simyanga, gúa*, Kól; *Krawru*, Magh; *Hila auwal*, Cachar; *Shelangri*, Gáro; *Kyetyo*, Burm.

A tree. *Bark* thick. *Wood* purplish- or reddish-grey, hard, close-grained. *Annual rings* distinctly marked by a white line. *Pores* small, moderate-sized, sometimes filled with a yellowish substance. *Medullary rays* fine, very numerous.

Sub-Himalayan tract and lower hills from Nepal eastwards, Assam, Khasia Hills and Chittagong; dry forests from the Rajmehal Hills through Chota Nagpore to Orissa and the Circars as far south as the Godavari; upper mixed and tropical forests in Burma.

This tree, var. *Roxburghiana*, has leaves with winged petioles like those of *V. altissima* and *V. alata*, Heyne. Growth moderate, 6 to 8 rings per inch of radius. Weight 60 lbs. per cubic foot. Used in Cachar for posts and beams, in the Gáro Hills for sugar-cane crushers.

		lbs.
E 784.	Kámrúp, Assam (G. Mason)	—
E 1393.	Chittagong (Chester)	60
B 1423.	Tharrawaddy, Burma (Brandis)	60

7. V. leucoxylon, Linn. f.; Fl. Br. Ind. iv. 587; Roxb. Fl. Ind. iii. 74; Bedd. Fl. Sylv. clxxi.; Brandis For. Fl. 370; Talbot Bomb. List 162; Trimen Fl. Ceyl. iii. 358. *V. saligna,* Roxb. Fl. Ind. iii. 75. Vern. *Songarbi, sherus,* Mar.; *Luki, konda vavili, neva-ledi,* Tel.; *Sengeni, senkani, karril, hola naki,* Kan.; *Jinnekoi,* Koya; *Kadu-nochchi, nir-nochchi,* Tam.; *Nébedda,* Cingh.

A tree. *Bark* grey, smooth. *Wood* light greyish-brown, moderately hard. *Pores* moderate-sized, often subdivided, evenly distributed. *Medullary rays* moderately broad, regular, with a silver-grain of narrow plates.

Forest regions of Western and Southern India and Ceylon: found along the banks of streams.

A conspicuous and pretty tree. Beddome says the wood is used for cart-wheels and deserves attention for furniture. It is certainly in demand in the Madras Presidency as a useful wood. Beddome gives W = 42 lbs., which is probably about right, the specimen examined is from a young tree.

		lbs.
D 5011.	Cuddapah (H. W. Gaudoin)	38

8. V. glabrata, Br.; Fl. Br. Ind. iv. 588. *V. leucoxylon,* Linn. f.; Kurz For. Fl. ii. 273. Vern. *Goda, hoima, ashwal,* Beng.; *Tokra,* Magh; *Tauksha,* Burm.

A deciduous tree. *Wood* grey, with a satiny lustre, moderately hard, close-grained, durable. *Annual rings* marked by a dark line. *Pores* small to moderate-sized, scanty. *Medullary rays* moderately broad, forming a well-marked silver-grain on a radial section.

Assam, Eastern Bengal, Chittagong and Burma, both in mixed and savannah forests; Andaman Islands.

A large and important tree. Growth averaging 6 rings per inch of radius. The following experiments have been made with the wood:—

	Weight in lbs.	P.
1831, Kyd, with Assam wood, bars 2′ × 1″ × 1″	40	337
1864, Brandis with Burma wood, bars 3′ × 1″ × 1″	39	763
1864, Brandis with Burma wood, bars 2′ × 1″ × 1″	39	508

Brandis in Burma List, No. 84, gives W = 42 lbs., but his specimen now weighs 40 lbs.; other specimens vary from 36 to 45 lbs.; 40 lbs. may be adopted as an average.

The wood is used for cart-wheels, and deserves attention for furniture and other purposes. Col. Ford says the fruit is eaten by Burmese in the Andamans, and that the bark and root are used medicinally.

		lbs.
E 1392.	Chittagong (Chester)	45
B 330.	Burma (1867)	40
B 2549.	„ (Brandis, (1862)	40
B 2711.	Tavoy (Wallich, 1828)	36
B 2218.	Andaman Islands (Col. Ford, 1866)	44

9. V. Agnus-castus, Linn.; Brandis For. Fl. 370. Vern. *Mehrwan,* Bal.

A large shrub or small tree. *Bark* dark brown, rough, deeply fissured vertically. *Wood* dark brown, hard, close-grained. *Annual rings* marked by a continuous line of pores in the spring wood; *pores* in the rest of the wood similar, scattered, often in short radial strings. *Medullary rays* very fine, numerous, regular.

Afghanistan and Baluchistan, eastward to Europe.

Lace mentions this as one of the chief shrubs characteristic of dry watercourses in the Harnai Valley, where it is gregarious, up to 4500 ft. It seems to have an excellent wood.

Algeria—Kew Museum (Col. Playfair).

Nordlinger's Sections, vol. 7.

7. CLERODENDRON, Linn.

About 15 species, erect or straggling shrubs or small trees, mostly with showy flowers. *C. inerme*, Gaertn.; Fl. Br. Ind. iv. 589; Roxb. Fl. Ind. iii. 58; Bedd. Fl. Sylv. clxxiv.; Brandis For. Fl. 363; Kurz For. Fl. ii. 266; Talbot Bomb. List 162; Trimen Fl. Ceyl. iii. 359; Vern. *Ban-jamat, batraj*, Beng.; *Pesung, pisangi*, Tel.; *Pinchil, pinari*, Tam.; *Wal-gurenda*, Cingh., is an evergreen shrub with white flowers, common in tidal forests on the coasts of India, Burma and Ceylon, and often planted as a hedge in gardens in the Coast Districts. *C. nutans*, Wall.; Fl. Br. Ind. iv. 591; Brandis For. Fl. 364; Kurz For. Fl. ii. 267; Gamble Darj. List 62; Vern. *Baichud*, Nep.; *Tongsor*, Lepcha; *Nyanpadu*, Burm., is a white-flowered shrub of evergreen forests in Northern and Eastern Bengal and Burma, sometimes cultivated in gardens. *C. serratum*, Spreng.; Fl. Br. Ind. iv. 592; Brandis For. Fl. 364; Kurz For. Fl. ii. 267; Gamble Darj. List 62; Talbot Bomb. List 162; Trimen Fl. Ceyl. iii. 360 (*Volkameria serrata*, Roxb. Fl. Ind. iii. 62); Vern. *Barangi*, Hind.; *Banbakri*, Jaunsar; *Chúa*, Nep.; *Yi*, Lepcha; *Manno*, Kumaon; *Makamauna*, Garhwal; *Vatamadukki*, Tam.; *Ken-henda*, Cingh.; *Begyo*, Burm., is a shrub, usually herbaceous, but occasionally woody, with blue handsome flowers, common in the Lower Himalaya, and thence almost throughout India and Burma and Ceylon. *C. venosum*, Wall.; Fl. Br. Ind. iv. 592 (*Volkameria farinosa*, Roxb. Fl. Ind. iii. 64); Vern. *Taleuser*, Sylhet, is a large shrub or small tree with well-marked trunk, of the Khasia Hills, at 4000 ft. *C. bracteatum*, Wall.; Fl. Br. Ind. iv. 593; Gamble Darj. List 62; Vern. *Chitu*, Nep.; *Kadungnyok*, Lepcha, is a large shrub or small tree with white flowers, found in the Eastern Himalaya at 2-5000 ft., also in Assam and the Khasia Hills, chiefly in old cultivated lands. *C. squamatum*, Vahl.; Fl. Br. Ind. iv. 593; Gamble Darj. List 62; Vern. *Chitu*, Nep.; *Rotdhip*, Lepcha, is a beautiful scarlet-flowered shrub of the forest undergrowth in the Eastern Himalaya, Khasia Hills and Sylhet, often cultivated. The natives of the hills are fond of the flowers and frequently gather and wear them in their turbans. *C. infortunatum*, Gaertn.; Fl. Br. Ind. iv. 594; Bedd. Fl. Sylv. clxxiii.; Brandis For. Fl. 362; Kurz For. Fl. ii. 267; Gamble Darj. List 62; Talbot Bomb. List 162; Trimen Fl. Ceyl. iii. 361 (*Volkameria infortunata*, Roxb. Fl. Ind. iii. 59); Vern. *Pasvik*, Kashmir; *Bhánt, bhat*, Hind.; *Karu*, Dehra Dún; *Rhodelu*, Kumaon; *Rhodera*, Garhwal; *Chitu*, Nep.; *Kadung*, Lepcha; *Lukunah*, Mechi; *Bania*, Uriya; *Kula marsál*, Kól; *Papa*, Reddi; *Ka-aunggyi*, Burm.; *Gas-pinna*, Cingh., is one of the commonest shrubs in the plains and lower hills all over India, Burma and Ceylon. It is very common in the underwood of Sál forests; in open places in mixed forests; in old cultivated lands; under isolated large trees, such as the mango, banyan and pipal; in mango and other topes; and about villages; and in some places becomes a small tree with a distinct stem. The flowers are pinkish-white in large terminal panicles. *C. Siphonanthus*, Br.; Fl. Br. Ind. iv. 595; Brandis For. Fl. 364; Gamble Darj. List 62; Talbot Bomb. List 163 (*Siphonanthus indica*, Linn.; Roxb. Fl. Ind. iii. 67); Vern. *Barangi*, Hind.; *Chingári*, Dehra Dún; *Bamunhatti*, Beng.; *Ngayanpadu*, Burm., is a shrub of grass lands in most parts of India, conspicuous for its very long-tubed white flowers and red persistent calyx surrounding bluish-green drupes. Heinig says it is cut for firewood in the Sundarbans. *C. fragrans*, Vent., is a cultivated shrub with very sweet-scented, double, pinkish-white flowers, common in gardens and often found run wild.

1. **C. phlomoides**, Linn. f.; Fl. Br. Ind. iv. 590; Roxb. Fl. Ind. iii. 57; Bedd Fl. Sylv. clxxiv.; Brandis For. Fl. 363; Talbot Bomb. List 162. *C. Phlomidis*, Trimen Fl. Ceyl. iii. 360. Vern. *Urni*, Hind.; *Irun, arni*, Guz.; *Vatamadakki*, Tam.; *Telaki*, Tel.; *Takal*, Berar.

A large shrub. *Bark* light brown, thin, smooth. *Wood* grey, hard, close-grained, annual rings faintly visible. *Pores* small, in short radial lines of 1 to 4, chiefly in spring wood. *Medullary rays* numerous, fine, distinct.

Throughout India, in dry regions, also Ceylon.
A common plant in hedges, scarce in the forests. Flowers white or pink.
D 4329. Kondavid, Kistna (Gamble).

2. **C. Colebrookianum**, Walp.; Fl. Br. Ind. iv. 594; Gamble Darj. List 62. Vern. *Kadungbi*, Lepcha.

A small evergreen tree. *Bark* silver-grey. *Wood* grey, soft. *Pores* large and moderate-sized, often subdivided, the large pores arranged in interrupted concentric lines, and all pores, especially the smaller ones, joined by irregular concentric bands of soft tissue. *Medullary rays* moderately broad and fine, irregularly distributed.

Sikkim and Khasia Hills, 1–6000 ft.; Burma (scarce) but extending north to Myitkyina.

A plant of second-growth forest, in fellings, clearings and old cultivated lands. The whole plant has a strong disagreeable smell; the young leaves are eaten by Lepchas. The flowers are white and the berries turquoise-blue.

		lbs.
E 2401.	Tukdah Forest, Darjeeling, 5000 ft. (Gamble)	29

8. HOLMSKIÖLDIA, Retz.

1. **H. sanguinea**, Retz; Fl. Br. Ind. iv. 596; Brandis For Fl. 370; Kurz For. Fl. ii. 256; Gamble Darj. List 62. *Hastingia coccinea*, König; Roxb. Fl. Ind. iii. 65. Vern. *Rithoul*, Dehra Dún; *Kul-tolia*, Kumaon; *Sarpattia*, Nep.; *Sivettachin*, Lepcha.

A large straggling shrub. *Bark* reddish-brown, rough, with short horizontal fissures and few vertical bands. *Wood* light red, moderately hard. *Pores* large and numerous in spring wood, small and more scanty in the rest, often much subdivided, enclosed in tissue of pale colour and loose texture, the large pores prominent on a vertical section. *Medullary rays* fine, numerous, giving a silver-grain of narrow reddish plates.

Sub-Himalayan tract and lower hills from the Sutlej eastwards, rising to 4000 ft.; dry hills of Prome in Burma: often cultivated.

A very conspicuous plant with red flowers and large red funnel-like persistent calyx. It is common in ravines and on the banks of streams.

		lbs.
H 4457.	Malkot, Dehra Dún, 3000 ft. (Gamble)	43

Tribe III. CARYOPTERIDEÆ.

9. CARYOPTERIS, Bunge.

Three species, erect or straggling shrubs. *C. grata*, Benth., is found in the Himalaya from the Sutlej to Nepal, up to 5000 ft.; and *C. paniculata*, Clarke, in the Darjeeling lower hills at a similar elevation, but both are scarce plants.

1. **C. Wallichiana**, Schauer; Fl. Br. Ind. iv. 597; Brandis For. Fl. 370; Gamble Darj. List 63. Vern. *Chingári*, *karni*, Dehra Dún; *Moni*, *mohdni*, Kumaon; *Shechin*, Nep.; *Malet*, Lepcha.

A large shrub. *Bark* thin, grey, papery, peeling off in vertical strips. *Wood* yellowish- or pinkish-grey, moderately hard, with the scent of cherry wood. *Pores* small, often in groups, the groups arranged more or less concentrically. *Medullary rays* moderately broad, showing a silver-grain of broadish plates.

Outer Himalaya, from the Indus to Bhutan, ascending to 5000 ft.

A common and conspicuous lilac-flowered shrub with a nice wood. Growth rapid, 5 rings per inch of radius.

		lbs.
O 4408.	Dehra Dún, 2000 ft. (Gamble)	50
E 2402.	Chunbati, Darjeeling, 2000 ft. (Gamble)	44
E 3668.	Rinkinpúng, Darjeeling, 3000 ft. „	—

10. **GLOSSOCARYA**, Wall. Two species. *G. scandens*, Trimen Fl. Ceyl. iii. 362, t. 72 (*G. Linnæi*, Benth.; Fl. Br. Ind. iv. 598), is "a beautiful climber over large 'trees which it covers with masses of blossom, but capable of growing as a bush"

(Trimen). It is endemic in the dry region of Ceylon. *G. mollis*, Wall.; Fl. Br. Ind. iv. 598; Kurz For. Fl. ii. 257, is a scandent shrub with quadrangular stems, found in Tenasserim.

11. HYMENOPYRAMIS, Wall. *H. brachiata*, Wall.; Fl. Br. Ind. iv. 598; Kurz For. Fl. ii. 258; Vern. *Chintheletnevè*, Burm., is a large deciduous scandent shrub of the dry forests of Prome in Burma.

Tribe IV. SYMPHOREMEÆ.

12. SYMPHOREMA, Roxb.

Two species.

1. **S. involucratum,** Roxb. Fl. Ind. ii. 262; Fl. Br. Ind. iv. 599; Talbot Bomb. List 163; Trimen Fl. Ceyl. iii. 363. Vern. *Thamaka, nwèzat*, Burm.

A climbing shrub. *Bark* thick, grey, corky, deeply fissured vertically. *Wood* white, soft, porous. *Pores* large, often subdivided, in wedges between the few moderately-broad *medullary rays*.

Hills of the Western Ghâts from the Konkan southwards; Ceylon; Monghyr Hills in Behar.

W 4262. Nilgiri Hills, 4000 ft. (Gamble).

2. **S. polyandrum,** Wight; Fl. Br. Ind. iv. 599; Talbot Bomb. List 163.

A climbing deciduous shrub. *Bark* grey, shining, vertically pleated, covered with small round lenticels. *Wood* grey, soft. *Pores* moderate-sized, rather scanty, between the fine *medullary rays*.

Hills of the South Deccan, in dry ravines.

D 3871. Horsleykonda, Cuddapah, 3000 ft. (Gamble).

13. SPHENODESMA, Jack. Six species, scandent shrubs. *S. unguiculata*, Schauer; Fl. Br. Ind. iv. 601 (*Symphorema unguiculatum*, Kurz For. Fl. ii. 255); Vern. *Kanwè*, Burm., is a large deciduous climbing shrub of the Khasia Hills, Eastern Bengal, Burma and the Andaman Islands, and is the one of most interest.

14. CONGEA, Roxb.

Four species, climbing shrubs. *C. vestita*, Griff. and *C. velutina*, Wight are both large species of Tenasserim; and *C. villosa*, Wight; Fl. Br. Ind. iv. 603 (*Roscoea villosa*, Roxb. Fl. Ind. iii. 56), is found also in Pegu and is common about Rangoon.

1. **C. tomentosa,** Roxb.; Fl. Br. Ind. iv. 603; Kurz For. Fl. ii. 256. *Roscoea tomentosa*, Roxb. Fl. Ind. iii. 57. Vern. *Kayaw, kanamaung, nwèzat, thamakanwè*, Burm.

A large climbing shrub. *Bark* dark brown, much fluted, rough. *Wood* in an irregular central ring, succeeded by a layer of bast-tissue, then by rounded patches of wood-tissue and more bast layers following, and so on. *Pores* large, in lines between the moderately broad to broad *medullary rays*. Pores conspicuous on vertical sections.

Forests of Chittagong and Burma.

A beautiful climber with lilac-coloured bracts. The specimens have come under the name *C. tomentosa*, under which, apparently, Kurz places both of Roxburgh's species; so I have described them under that name, but I am inclined to think they really belong to *C. villosa*, which is the more common kind in Pegu. The var. *azurea*, Clarke, is often cultivated in India.

B 5028. Tharrawaddy Division, Burma

TRIBE V. AVICENNIEÆ.

15. AVICENNIA, Linn.

1. **A. officinalis**, Linn.; Fl. Br. Ind. iv. 604; Bedd. Fl. Sylv. clxxiv.; Brandis For. Fl. 371; Kurz For. Fl. ii. 275; Talbot Bomb. List 163; Trimen Fl. Ceyl. iii. 363. *A. tomentosa*, Jacq.; Roxb. Fl. Ind. iii. 88; Kurz For. Fl. ii. 276. Vern. *Bani*, *baen*, Beng.; *Mada*, Tel.; 2 vars. *Venkandan*, *karungandan*, Tam. in S. Arcot; 3 vars. *Nalla-*, *tella-* and *gumda-mada*, Tel. in Kistna; *Thamè*, Burm.

A shrub or small tree. *Bark* greyish-brown, thin. *Wood* brown or grey, hard, in alternate layers of pore-bearing tissue and loose large-celled tissue without pores: the former layer shows the large moderate-sized or small pores in radial strings of 1 to 5 between the fine short *medullary rays*; the latter is much narrower and darker, forming belts which occasionally join each other, so that the layers are clearly not annual growths.

Salt marshes, coast and tidal forests of India, Burma, and the Andaman and Nicobar Islands.

One of the most common of the so-called "Mangroves" with a wood of very peculiar structure. On the question of the layers corresponding to periodical growths see "Ind. Forester," xix. 104; xxiii. 324, 413; and xxiv. 58. Mr. A. W. Lushington considered the layers due to the alternation of spring and neap tides. More investigation of the subject is badly needed. This tree, like other mangroves, has the property of sending out very numerous leafless blind root-suckers which are believed to assist in respiration in the same way as lenticels do. Weight 40 to 58 lbs. per cubic foot. The wood is very brittle, and used only for firewood. Col. Ford says it is used for mills for husking paddy, rice-pounders, and oil-mills in the Andamans.

			lbs.
E 398.	Sundarbans (Richardson)		58
B 2284.	Andaman Islands (Col. Ford, 1866)		58
D 4326.	Tummalapenta, Nellore (Brougham)		—
D 4108.	S. Arcot (Wooldridge)	smooth bark var.	50 brown colour.
D 4109.	S. Arcot (Wooldridge)	rough "	41 grey "

Nordlinger's Sections, vol. 3 (Tab. XI. 6).

ORDER LXXXIII. LABIATÆ.

An Order containing chiefly more or less aromatic herbaceous plants, many of which, like the thyme, mint, sage, marjoram, and the "*tùlsi*" plant, are well known; and among woody plants only a few shrubs or small trees (*Leucosceptrum*). There are about eight Indian genera with woody species belonging to five Tribes:—

Tribe I. Ocimoideæ	Plectranthus.
" II. Satureineæ	Colebrookia, Elsholtzia.
" III. Monardeæ	Meriandra.
" IV. Stachydeæ	Colquhounia, Roylea, Leucas.
" V. Ajugoideæ	Leucosceptrum.

The Rosemary (*Rosmarinus officinalis*, Linn.), a shrub of the Mediterranean region, is sometimes cultivated in hill gardens.

Wood light-coloured, hard. *Pores* small or very small, generally in groups. *Medullary rays* moderately broad, distant.

1. PLECTRANTHUS, L'Hér.

1. **P. rugosus**, Wall.; Fl. Br. Ind. iv. 620. Vern. *Khwangere*, Trans-Indus; *Itsit*, Salt Range; *Búi*, Jhelum; *Solei*, Kashmir; *Piúmar*, *chiúpi*, Chenab; *Kot*, *siringri*, Ravi; *Pek*, *rosbang*, *chichri*, Sutlej; *Chichli*, Jaunsar.

A small shrub with brown *bark*. *Wood* grey, hard. *Pores* small

and very small. *Medullary rays* moderately broad. *Annual rings* marked by a narrow belt of more numerous pores.

Common on dry hillsides and rocks in the West Himalaya at 3–8000 ft.; Mount Abu in Marwar.

H. 2840. Simla, 7000 ft. (Gamble).

2. COLEBROOKIA, Sm.

1. **C. oppositifolia**, Sm.; Fl. Br. Ind. iv. 642; Kurz For. Fl. ii. 277; Gamble Darj. List 63; Talbot Bomb. List 164. *C. ternifolia*, Roxb. Fl. Ind. iii. 25. Vern. *Shakardana*, Trans-Indus; *Phis bekkar*, Salt Range; *Dúss*, *sampni*, Jhelum; *Súáli*, Chenab; *Dúss*, Ravi; *Briali*, *basuti*, Beas; *Barmera*, Sutlej; *Binda*, Garhwal; *Lúbri*, *bambher*, Jaunsar; *Dulshat*, Kumaon; *Dosúl*, Nep.; *Dussarika jhar*, *bhamini*, Mar.; *Merota*, *darigopa*, Khond.

A shrub with irregularly indented stem. *Bark* grey, rather corky. *Wood* greyish-white, moderately hard, close-grained. *Pores* small, scanty, often in pairs. *Medullary rays* moderately broad; the distance between the rays several times larger than the diameter of the pores.

Lower Himalaya and sub-Himalayan tract from the Indus to Bhutan at 1–4000 ft.; Central, Southern and Western India in valleys and ravines; Upper Burma, Kachin Hills, Shan Hills and Tenasserim.

A common shrub, conspicuous when in flower and fruit. The wood is used for gunpowder charcoal and the leaves applied to wounds and sores (Stewart).

		lbs.
H 3046.	Kumharsen, Sutlej Valley, 2500 ft. (Gamble)	46
O 4668.	Dehra Dún, 2500 ft. (Gamble)	48

3. ELSHOLTZIA, Willd.

1. **E. polystachya**, Benth.; Fl. Br. Ind. iv. 643. Vern. *Rangchari*, *mehndi*, Jhelum; *Garúdar*, *tappaddar*, Chenab; *Dúss*, Ravi; *Pothi*, Sutlej; *Pathoi*, *potha*, Jaunsar; *Bhangria*, Kumaon.

A deciduous shrub. *Bark* grey, fibrous, peeling off in thin, longitudinal strips. *Wood* grey, moderately hard. *Annual rings* distinctly marked by a belt of numerous and larger pores in the spring wood; in the rest of the wood *pores* small, scanty. *Medullary rays* moderately broad, distant.

Western Himalaya, from the Jhelum eastwards, and the Khasia Hills, at 6–10,000 ft.

Growth slow, 15 rings per inch of radius. Common in forest undergrowth, growing often to 10 or 12 ft. high, also more or less gregarious on hillsides, in company with *Indigofera*, *Desmodium*, etc., and useful in giving protection to seedlings of deodar and blue pine.

A good wood, but the stems split and warp very badly in seasoning, and the size is not sufficiently large for it to be of use except for small fuel.

		lbs.
H 2841, 2936.	Mahasu, Simla, 7000 ft. (Gamble)	42
H 4783.	Jaunsar Forests, W. Himalaya, 7000 ft. (Gamble) . . .	36

4. MERIANDRA, Benth.

M. bengalensis, Benth., is sometimes cultivated in Indian gardens as a substitute for sage.

1. **M. strobilifera**, Benth.; Fl. Br. Ind. iv. 652.

A small shrub with grey *bark*. *Wood* white, hard. *Pores* small and very small. *Medullary rays* fine, numerous. *Annual rings* marked by an interrupted line of larger pores on the inner edge, and a narrow belt of firmer wood on the outer edge of each ring.

West Himalaya, about 6000 ft., from Simla to Kumaon.

The leaves are very aromatic, having the scent of sage; they are distinguished from those of *Elsholtzia polystachya* by being sagittate. The shrub is chiefly found on dry rocks, especially limestone.

H 2839. Simla, 6500 ft. (Gamble).

5. COLQUHOUNIA, Wall. Four species are described in the "Fl. Br. Ind.," but Hooker expresses himself as unable properly to distinguish the first three; the fourth, *C. tenuiflora*, Hook. f., of Burma, being quite distinct. *C. coccinea*, Wall. and *C. vestita*, Wall.; Fl. Br. Ind. iv. 674, are shrubs of the Himalaya from Kumaon to Sikkim at 6–9000 ft., the latter extending to the Khasia Hills. *C. elegans*, Wall.; Fl. Br. Ind. iv. 674; Kurz For. Fl. ii. 278, is a scandent or semi-scandent shrub of the damp hill forests of Martaban, and the Shan Hills of Burma. Collett says, "In the 'Shan Hills it is certainly erect. It is very common all over the Shan plateaux. It 'attains a height of 8 to 10 ft."

6. ROYLEA, Wall.

1. **R. elegans**, Wall.; Fl. Br. Ind. iv. 679. Vern. *Kaur, kauri*, Pb.; *Karanoi*, Jaunsar; *Titpáti*, Kumaon; *Patkarru*, Hind.

A shrub. *Bark* grey. *Wood* white, hard. *Pores* small and very small, in groups and short tails. *Medullary rays* moderately broad, unequally distributed.

West Himalaya, from the Ravi to Nepal, up to 3000 ft.

A handsome shrub, more or less gregarious on dry hillsides.

		lbs.
H 3045.	Kumharsen, Sutlej Valley, 4000 ft. (Gamble)	52

7. LEUCAS, Br.

A large genus of rather conspicuous herbs and undershrubs, only one of which reaches any size. They are characteristic plants of the Deccan and hills of S. India.

1. **L. lanceæfolia**, Desf.; Fl. Br. Ind. iv. 685.

A large shrub. *Bark* thin, grey, with oblique raised lines. *Wood* light brown, moderately hard. *Pores* small, in groups or short radial lines. *Medullary rays* fine, short.

Nilgiri Hills at 6–8000 ft.

A common shrub in the "sholas" and often more or less gregarious. It prefers the outskirts and open places rather than the shade.

W 3811. Ootacamund, 7000 ft. (Gamble).

8. LEUCOSCEPTRUM, Sm.

1. **L. canum**, Sm.; Fl. Br. Ind. iv. 699; Gamble Darj. List 63. Vern. *Matsola, gurupis*, Nep.; *Chúng*, Lepcha.

A small evergreen tree. *Bark* yellowish-brown, thin, corky. *Wood* yellowish-white, moderately hard, close- and even-grained, smooth, but warps badly. *Pores* small, scanty, subdivided and in small groups, which have a faint general concentric arrangement. *Medullary rays* moderately broad, rather distant, showing a shining silver-grain. *Annual rings* indistinctly marked.

Himalaya from Kumaon to Bhutan at 2–8000 ft.; Khasia Hills, 4–5000 ft.; Shan Hills plateau at 4000 ft.; also Ruby Mines District and Kachin Hills.

Growth rapid, 3 to 5 rings per inch of radius. Weight 38 to 41 lbs. per cubic foot. A common tree in second-growth forests in the Sikkim Hills, and easily recognized by its greyish foliage and long erect spikes of dirty-white flowers with long-exserted stamens. Its wood is a fair fuel. It coppices well and strikes easily from cuttings.

		lbs.
E 2411.	Rangbúl, Darjeeling, 7000 ft. (Gamble)	41
E 3376.	Darjeeling, 6500 ft. (Gamble)	38

Series V. APETALÆ.

Order LXXXIV. NYCTAGINEÆ.

One indigenous genus, Pisonia, and one, Bougainvillæa, introduced from South America and cultivated in gardens everywhere in the plains.

1. PISONIA, Linn.

Three species. *P. alba*, Span.; Fl. Br. Ind. iv. 711; Kurz For. Fl. ii. 279, is an evergreen tree of the beach forests of the Andaman Islands, cultivated in gardens in coast towns in India as in Calcutta, Madras, Colombo, etc. It is known as the "Tree Lettuce," and Wight says "it somewhat resembles the lettuce in taste, but is but an 'indifferent substitute." The leaves are pale green, those at the ends of the branches often nearly white. *P. excelsa*, Bl.; Fl. Br. Ind. iv. 711 (*P. umbellifera*, Seem.; Kurz For. Fl. ii. 289), is also a tree of the coast forests of the Andamans, more common in the wild state than *P. alba*.

1. **P. aculeata**, Linn.; Fl. Br. Ind. iv. 711; Roxb. Fl. Ind. ii. 217; Kurz For. Fl. ii. 279; Bedd. Fl. Sylv. clxxv.; Talbot Bomb. List 164; Trimen Fl. Ceyl. iii. 391. Vern. *Hati-ankusa*, Uriya.

A large thorny climbing shrub. *Bark* light brown, thin. *Wood* light brown, soft, of peculiar structure. *Pores* regularly arranged, very large, single or subdivided, in crescent-shaped groups, with 2 or 3 moderate-sized pores radially arranged on the inside of each. *Medullary rays* very fine, very numerous: they often pass through and subdivide the pores.

Coast jungles on both sides of the Peninsula from the Konkan on the West and Orissa on the east southwards; coast of Burma; Ceylon.

A very troublesome thorny plant, chiefly of dry evergreen coast forests, also found among bushes in open lands and in hedges. A good hedge plant green or dry.

C 3507. Khurdha Forests, Orissa (Gamble).
D 4322. Striharikota, Nellore „

2. BOUGAINVILLÆA, Commers.

1. **B. spectabilis**, Willd.

A large climbing thorny shrub. *Bark* brown. *Wood* yellow, hard. *Pores* moderate-sized to large in patches of a few radially or slightly obliquely disposed, the patches distant. *Medullary rays* fine, short, numerous. Faint concentric, wavy, bands of loose texture (large wood-cells) regular, but often anastomozing.

Introduced from South America; cultivated in gardens throughout the Indian plains.

A very showy plant, with large pink or purple bracts. There is another species or variety with brick-red bracts, soft leaves and a corky bark, which grows even larger.

		lbs.
O 4469.	Dehra Dún Forest Garden	31

Order LXXXV. AMARANTACEÆ.

A large Order of chiefly herbaceous plants, only three genera of which, in the Indian region, reach woody size. These are—

Tribe I. Celosieæ	Deeringia.
„ II. Amaranteæ	Bosia, Stilbanthus.

Wood of the two species described, similar in character to that of MENISPERMACEÆ, consisting of alternate zones of bast tissue without *pores* and pore-bearing tissue divided into wedges by the *medullary rays*.

1. DEERINGIA, Br.

1. D. celosioides, Br.; Fl. Br. Ind. iv. 714; Roxb. Fl. Ind. i. 682; Gamble Darj. List 63. Vern. *Gola-mohani*, Beng.; *Chúndri*, Dehra Dún; *Kala loári*, Kumaon; *Latman*, Hind.

A climbing shrub. *Bark* dark grey, thin, rough. *Wood* dark grey, soft, divided into irregular zones by more or less concentric but anastomozing narrow belts of bast tissue. *Between* these belts comes a broader ring of pore-bearing tissue, which is divided up radially into wedges by the moderately-broad *medullary rays*. In the wedges the *pores* are few, small to moderate-sized, radially disposed.

Northern India; in the Lower Himalaya up to 5000 ft. and the sub-Himalayan tract from the Sutlej to Bhutan; Assam, the Khasia Hills, Chittagong and Upper Burma; Behar: chiefly in hedges and among bushes.

A conspicuous plant in the cold season, when its long panicles of bright red berries are very noticeable. U. N. Kanjilal says the juice of the fruit can be used as red ink.

		lbs.
H 4460.	Malkot Forests, Dehra Dún, 4000 ft. (Gamble)	40

2. BOSIA, Linn.

1. B. Amherstiana, Hook. f.; Fl. Br. Ind. iv. 716. Vern. *Bilga*, Koti; *Bhengoi*, Jaunsar.

A large straggling shrub. *Bark* thin, brown, rough. *Wood* grey, soft, divided by concentric and anastomozing belts of bast tissue into irregular zones. Between these narrow belts are broader rings of pore-bearing tissue, subdivided into radial wedges by short medullary rays varying in breadth, which gradually widen where they join the concentric belts of loose tissue which are apparently of the same structure. *Pores* large and moderate-sized, numerous, often subdivided, irregularly arranged in the wedges.

West Himalaya at 4–7000 ft., from Kashmir to Kumaon.

It seems to be often grown as a hedge; the young shoots are eaten fried in ghee, and a black dye is obtained from the leaves. The berries, which are bright crimson, resembling those of *Deeringia*, are also eaten (U. N. Kanjilal).

		lbs.
H 3097.	Koti, near Simla, 6000 ft. (Gamble)	41

3. STILBANTHUS, Hook. f.

1. S. scandens, Hook. f.; Fl. Br. Ind. iv. 729; Gamble Darj. List 63.

A large climbing shrub. *Bark* light brown, rough. *Wood* very soft, fibrous, scarcely showing a woody structure, consisting of broad layers of pore-bearing tissue concentrically arranged, alternating with narrow layers of bast tissue. *Pores* very large, often subdivided, thick-walled. *Medullary rays* not apparent.

Sikkim Himalaya at 5–7000 ft.

This climber is quite conspicuous about Darjeeling, growing over tall trees and covering them with masses of whitish flowers. In the "Working Plan of the Darjeeling Division," 1893, F. B. Manson, quoting H. H. Haines, says, "This climber is easily 'recognized by its square branches and opposite leaves, and by the nodes of the stem

'of large trees it will reach the topmost branches and entirely cover the crown of the 'tree with its foliage. In partially cleared, and especially in damp, situations, it forms 'a dense and tangled growth. Reproduction becomes impossible unless it is cut back 'wherever it appears."

Sikkim Himalaya, 5–6000 ft.—Kew Museum (J. D. Hooker).

ORDER LXXXVI. CHENOPODIACEÆ.

An order containing chiefly herbaceous plants, interesting because various species form the chief vegetation of the salt plains, especially near the sea-coast. These belong chiefly to the genera Arthrocnemum (*A. indicum*, Moq. of Northern and *A. glaucum*, Ung. Sternb. of Southern India, fleshy leafless jointed shrubs); Salicornia (*S. brachiata*, Roxb., also a fleshy-jointed undershrub); Suæda, Haloxylon and Salsola. The three last are the only ones with species reaching any size.

1. SUÆDA, Forsk.

Three more or less shrubby species. *S. fruticosa*, Forsk.; Fl. Br. Ind. v. 13; Vern. *Shorag*, Baluch. is found in the plains of the Punjab, and in Baluchistan. *S. nudiflora*, Moq.; Fl. Br. Ind. v. 14; Trimen Fl. Ceyl. iii. 409, is a small salt bush shrub of the coasts of South India and Ceylon, found with *S. monoica*, and used for the same purposes.

1. **S. monoica**, Forsk.; Fl. Br. Ind. v. 13; Trimen Fl. Ceyl. iii. 408. Vern. *Ella-kura*, Tel.; *Karuvamari*, Tam.

A branching shrub. *Bark* blackish-brown, very thin, rough. *Wood* greyish-white, almost black in the centre, moderately hard. *Pores* small, arranged in wavy concentric belts of soft tissue, often anastomozing and separated by belts of equal width but of harder and darker tissue without pores. Belts very numerous and narrow. *Medullary rays* very few, moderately broad to broad.

Salt swamps on the sea-coast of South India and Ceylon.

The wood is used for fuel and the green leaves are sometimes eaten in time of famine, when they have proved useful. The whole plant is salt and gives barilla.

		lbs.
D 3754.	Striharikota, Nellore (Gamble)	—
D 4119.	South Arcot coast (Wooldridge)	48

S. fruticosa, Forsk., has similar structure (Nordlinger's Sections, vol. 7).

2. HALOXYLON, Bunge.

Shrubs or small trees, with opposite jointed branches. *H. recurvum*, Bunge; Fl. Br. Ind. v. 15, is a straggling bush of the Punjab, Baluchistan, Sind, the South Deccan and Burma. The other species given in "Fl. Br. Ind." are quite small; but in the Baluchistan region occur at least two species of greater size and of some importance.

1. **H. Ammodendron**, Boiss. Fl. Or. iv. 948. Vern. *Tahg*, Afgh.; *Tar-gaz*, Baluch.

A small tree or large shrub. *Bark* yellow, smooth. *Wood* hard, brown (sapwood white), horny, in layers the inner part of which is hard and dark and has no *pores*, while in the outer lighter-coloured part there are groups of small pores in the pale loose tissue, the groups running into each other as a roughly concentric ring. The inner edge of the light part is wavy, and the layers are not fully continuous, as they sometimes stop and sometimes anastomoze.

Northern Baluchistan (Aitchison).

This is a low thick-stemmed tree, reaching 14 ft. in height and up to 12 ft. in girth. The wood is an excellent fuel and gives a green dye.

Afghanistan—Kew Museum (Aitchison).

2. **H. Griffithii**, Boiss. Fl. Or. iv. 950.

A shrub. *Bark* light brown, very irregularly cleft and fissured. *Wood* similar to that of *H. Ammodendron*, but the layers are in crenulate arcs.

Afghanistan and Baluchistan.

The stems and roots are used for fuel, and the branches are used to feed sheep in the winter. Lace says that the charcoal made from the wood is prized by blacksmiths.

Baluchistan—Kew Museum (Aitchison).

3. SALSOLA, Linn. *S. fœtida*, Del.; Fl. Br. Ind. v. 18; Vern. *Shora*, Baluch., is a large shrub of Sind, Baluchistan and the Punjab. It is very common in the Changa-Manga Plantation, as a gregarious undergrowth in places. Aitchison says it is common in Baluchistan and reaches 4 ft. in height. It is burnt for barilla. *S. arbuscula*, Pall. is a shrub of the desert country of Baluchistan, giving an excellent camel-fodder.

ORDER LXXXVII. POLYGONEÆ.

An Order containing many herbaceous plants, but only a few which, in India, reach the size of shrubs. These belong to four genera, in two Tribes, viz.—

Tribe I.	Eupolygoneæ . . .	Calligonum, Pteropyrum, Polygonum.
„ II.	Rumiceæ	Rumex.

Atraphaxis spinosa, Linn.; Brandis For. Fl. 373, is a thorny shrub of Afghanistan and Baluchistan, found on dry stony hills. *Antigonon leptopus*, Hk. and Arn. is the "Coral Creeper," a well-known pink-flowered S. American climber, common in gardens throughout India. Several species of Rhubarb (*Rheum*) are found in the Himalaya. *Muehlenbeckia platyclada*, Meissn., a plant of the Solomon Islands, remarkable for its flattened leafless branches, is common in Indian gardens.

1. CALLIGONUM, Linn.

1. **C. polygonoides**, Linn.; Fl. Br. Ind. v. 22; Brandis For. Fl. 372; Talbot Bomb. List 164. Vern. *Balanja, berwaja, tatúke*, Trans-Indus; *Phók, phóg*, Pb.

A slow-growing, nearly leafless, often gregarious shrub. *Bark* reddish-grey, rough, peeling off in long thin flakes; inner substance red. Most old stems are hollow. Heartwood reddish-brown, very hard. *Annual rings* distinctly marked by a continuous belt of moderate-sized and large pores; in the outer portion of each annual ring the *pores* are small, in groups, scanty, often joined by wavy lines of soft tissue. *Medullary rays* fine, numerous.

Sind, the Punjab and Rajputana, Afghanistan; common in the Bikanir desert and in the Western Punjab.

It is chiefly used for fuel, but twigs and branches are sometimes employed for the walls and roofs of huts. The abortive flowers are swept up and eaten, either made into bread or cooked with ghee. The shoots and branches are eagerly browzed by camels and goats.

P 889. Multán.

2. PTEROPYRUM, Jaub. and Spach. *P. Oliveri*, Jaub. and Spach; Fl. Br. Ind. v. 23; Talbot Bomb. List 165, is a much-branched shrub of Sind. *P. Aucheri*, Jaub. and Spach, is a shrub of Northern Baluchistan found in the beds of dry watercourses.

3. POLYGONUM, Linn.

A genus containing a large number of herbaceous plants, and about five which, in the Himalaya, reach the size of shrubs. *P. polystachyum*, Wall.; Fl. Br. Ind. v. 50; Gamble Darj. List 63, is a pink-flowered shrub found throughout the Himalaya at

are also found in the inner Himalaya, chiefly Central, in Garhwal and Kumaon, at 6–9000 ft. *P. rude*, Meissn. is a shrub of the Khasia Hills at 4–5000 ft.

1. **P. molle,** Don; Fl. Br. Ind. v. 50; Gamble Darj. List 63. Vern. *Totnye, tuknu, patu-swa*, Nep.

A large trailing shrub, with thin, dark grey bark and hollow stems. *Wood* reddish-white. *Annual rings* marked by a belt of moderate-sized pores; in the outer portion of each ring the *pores* are small, scanty, often in groups. *Medullary rays* moderately broad, often in pairs, irregularly distributed.

Eastern Himalaya from Nepal to the Mishmi Hills, at 5–8000 ft., very common at Darjeeling.

An extremely common, often almost gregarious, and scandent or straggling shrub. It is very troublesome sometimes, growing with great rapidity and covering the ground with interlacing branches, so preventing the reproduction of trees. It is, however, valuable as an agent to reclothe landslips, and has been successfully employed for that purpose, cuttings of it striking with great facility and layers taking root with ease. The young shoots are pleasantly acid and may be eaten like rhubarb.

E 2412. Rangbi, Darjeeling, 5000 ft. (Gamble).

4. RUMEX, Linn.

1. **R. hastatus,** Don; Fl. Br. Ind. v. 60. Vern. *Katambal, khattimal*, Jhelam; *Ami*, Chenab, Ravi; *Malorigha, amla*, Beas; *Amlora*, Sutlej; *Almora*, Kumaon.

Generally an undershrub, sometimes a shrub. *Wood* light red, moderately hard. *Pores* small, more numerous at the inner edge of the *annual rings*. *Medullary rays* broad and very broad.

West Himalaya at 2500–9000 ft., chiefly on rocks and dry hillsides. The leaves are acid and can be eaten as sorrel.

H 3048. Kot, Sutlej Valley, 2500 ft. (Gamble).

ORDER LXXXVIII. NEPENTHACEÆ.

1. NEPENTHES, Linn. Contains two Indian species, which are, in fact, scarcely woody plants, though remarkable for the curious pitchers borne at the ends of the leaves on a prolongation of the midrib, and hence called "Pitcher plants." *N. distillatoria*, Linn.; Fl. Br. Ind. v. 68; Trimen Fl. Ceyl. iii. 420; Vern. *Bandura-wel*, Cingh., is a large soft-wooded climbing shrub, common in swampy places and by the sides of streams in Ceylon, and rising to 2000 ft. in the hills. Trimen says the stems are very tough and are used as ropes. *N. khasiana*, Hook. f.; Fl. Br. Ind. v. 70, is a smaller plant with short stout stem found in the Khasia and Jaintia Hills. The splendid species so much cultivated in European hothouses and in Indian Botanic Gardens come from the Malay Archipelago.

ORDER LXXXIX. ARISTOLOCHIACEÆ.

Two genera, Bragantia and Aristolochia.

1. BRAGANTIA, Lour.

Two species. *B. Dalzellii*, Hook. f.; Fl. Br. Ind. v. 73, is a scarce shrub of the forests of the Konkan.

1. **B. Wallichii,** Br.; Fl. Br. Ind. v. 73; Trimen Fl. Ceyl. iii. 421.

An erect shrub. *Bark* thin, grey, somewhat corky. *Wood* brown, moderately hard, with large pith in alternate layers of wood and

radial strings between the fine to broad *medullary rays.* Beyond the first woody layer is a layer of bast tissue, which is again followed by a further wood layer and then another bast layer, and so on. (See M. T. Masters, F.R.S., in *Journ. Linn. Soc.*, xiv. 487.)

Moist forest undergrowth in the Western Ghâts and Ceylon, up to 4000 ft.

W 3902. Devala, S.-E. Wynaad, 3000 ft. (Gamble).

2. ARISTOLOCHIA, Linn.

Five species, all climbing shrubs. *A. Roxburghiana*, Klotzsch; Fl. Br. Ind. v. 75; Gamble Darj. *List* 63 (*A. acuminata*, Roxb. Fl. Ind. iii. 489), is a climbing shrub of Northern and Eastern Bengal, Assam, Burma and South India. *A. platanifolia*, Duchart.; *A. saccata*, Wall.; *A. Cathcartii*, Hook. f., and *A. Griffithii*, Hook. f. and Th., are also all climbing shrubs of Northern and Eastern Bengal and Assam, of no great size. The *wood* of all is soft, porous and of interesting structure, the *pores* very large, and the *medullary rays* broad or very broad. Various introduced species are in common cultivation in Indian gardens.

ORDER XC. PIPERACEÆ.

1. PIPER, Linn.

The pepper vines are found in damp localities in the forests all over India, either as erect shrubs or as climbers which ascend, as does the ivy, by means of rootlets from the stem. In Northern India, *P. brachystachyum*, Wall.; Fl. Br. Ind. v. 87, is found in ravines in the Himalaya as far west as the Sutlej; while *P. Hamiltonii*, Cas. DC; Fl. Br. Ind. v. 88, is a large species found in the forests of Northern and Eastern Bengal and Assam. *P. subpeltatum*, Willd.; Fl. Br. Ind. v. 95; Trimen Fl. Ceyl. iii. 429, is a succulent shrub of the undergrowth of damp forests, conspicuous for its very large round leaves and long flower spikes. There seem to be only about 10 species really more or less woody. The black pepper of commerce is given by *Piper nigrum*, Linn., while *P. Betle*, Linn. is the Betel pepper, the cultivated species which gives the "pán" leaves universally used for chewing by natives, mixed with lime, areca-nut, cardomoms, cloves and other spices.

1. **P. argyrophyllum**, Miq.; Fl. Br. Ind. v. 93; Trimen Fl. Ceyl. iii. 428. Vern. *Wal-gammaris-wel*, Cingh.

A climbing shrub. *Bark* dark greyish-brown, rough. *Wood* brown. *Pores* of various sizes in small groups, in wedges between the conspicuous broad *medullary rays.*

Throughout Southern India and the low country of Ceylon.

A very common species. Trimen says it reaches 2½ in. in diameter and grows up trees, rooting like the ivy.

W 4129. Ootacamund, Nilgiris, 7000 ft. (Gamble).

ORDER XCI. MYRISTICACEÆ.

1. MYRISTICA, Linn.

The latest account of the Nutmeg genus is that given by Sir George King in vol. iii. of the Annals of the Royal Botanic Garden, Calcutta. Although but little change is made in it in the arrangement of the "Fl. Br. Ind." so far as India, Burma and Ceylon are concerned, Sir G. King's Monograph is the latest authority on the subject, introduces several new species and contains good drawings of all, so it is decidedly the best thing to do to adopt it in this work. Sir G. King gives 22 indigenous and one cultivated species. Of the indigenous kinds 4 are found in Bengal, 5 in Assam, 9 in Burma, 5 in the Andamans, 4 in Western India, 5 in South India and 4 in Ceylon. There are none in Central India, the North-Western Provinces or the Punjab, the most northerly limit being Sikkim, where there are 3 species, by no means common trees. The genus, therefore, is distinctly a tropical one.

M. ceylanica, A. DC; King Ann. Calc. iii. 289; Trimen Fl. Ceyl. iii. 434 (*M. laurifolia*, Hook. f. and Th., var. *ceylanica*; Fl. Br. Ind. v. 103), is a large tree of Ceylon, where also is found *M. Horsfieldii*, Bl.; King Ann. Calc. iii. 296; Bedd. Fl. Sylv. clxxvi.; Trimen Fl. Ceyl. iii. 435; Vern. *Ruk*, Cingh., a much more common species with fragrant flowers.

In the Sikkim Himalaya the representatives are *M. Kingii*, Hook. f., of low valleys at about 1000 ft.; *M. erratica*, Hook. f. and Th., of the hills at about 3–5000 ft.; and *M. longifolia*, Wall. (*M. linifolia*, Roxb. Fl. Ind. iii. 847); Vern. *Gurmungban*, Magh; *Zadeikpo*, Burm., of the low valleys, remarkable for its very long handsome leaves. All three extend to Assam, and the last to Chittagong and Burma. Chittagong and Assam also afford *M. Clarkeana*, King Ann. Calc. 325, while in Assam extending to Burma are found *M. amygdalina*, Wall.; King Ann. Calc. iii. 300; Fl. Br. Ind. v. 106; Kurz For. Fl. ii. 283; Vern. *Taungsaga*, Burm., and *M. gibbosa*, Hook. f. and Th.

M. glabra, Bl., *M. glauca*, Bl., *M. missionis*, Wall. (these last two under *M. glaucescens*, Hook. f. and Th.; Fl. Br. Ind. v. 111, and *M. corticosa*, Hook. f. and Th.; Kurz For. Fl. ii. 284), *M. geminata*, Miq. and *M. exaltata*, Wall., are all Burmese species. *M. andamanica*, Hook. f.; Fl. Br. Ind. v. 103; King Ann. Calc. iii. 294 (*M. elliptica*, Kurz For. Fl. ii. 282), and *M. Prainii*, King Ann. Calc. iii. 299, are trees of the Andaman Islands.

M. fragrans, Houtt.; Fl. Br. Ind. v. 102; King Ann. Calc. iii. 287 (*M. moschata*, Willd.; Roxb. Fl. Ind. iii. 843); Vern. *Jaiphal* (nutmeg); *Jati, jatri* (mace), is the tree whose beautiful pear-like fruit gives the valuable spices "nutmeg" and "mace," the former being the hard ruminated albumen and the latter the aril. It is a native of the Moluccas, but is cultivated in Ceylon and in India, but not to any great extent. Its cultivation has succeeded best at the branch Botanic Garden at Barliyár, in the very hot Coonoor valley on the eastern side of the Nilgiri Hills.

In an economic point of view, the wild Nutmegs of India are of no particular importance, except that the wood of one species, *M. Irya*, is handsome; and might, if sufficiently common to become an article of trade, repay export from the Andaman Islands. Nor have they, in sylviculture, any particular importance, for they are mostly denizens of the great mixed evergreen forests, where numbers of individuals are few and whence extraction is difficult.

Wood usually light, somewhat soft, reddish-brown (that of *M. Irya* is olive-grey), with regular prominent rings of hard wood without pores, looking like annual rings. *Pores* in short radial strings, moderate-sized, rather scanty, arranged in echelon. *Medullary rays* fine, numerous, irregular.

1. **M. malabarica**, Lamk.; Fl. Br. Ind. v. 103; King Ann. Calc. iii. 288; Bedd. Fl. Sylv. t. 269; Talbot Bomb. List 165. Vern. *Kánagi*, Kan.; *Shola vengai*, Kader; *Pathiri*, Mal.

A large tree. *Wood* reddish-grey, moderately hard. *Annual rings* doubtful, reddish distant concentric lines like annual rings conspicuous. *Pores* moderate-sized, oval, usually subdivided, arranged in short radial strings in echelon, not numerous, uniformly distributed. *Medullary rays* fine, not prominent.

Western Coast from the Konkan southwards, in the evergreen forests.

The wood is said to be used for building. The seeds give an oil which is used to burn and as an ointment. Bourdillon gives W = 34 lbs., P = 460, and says that the timber is not durable; his specimen gives W = 38 lbs. It gives a kind of gum kino (Kew Bull. 1897, p. 101).

		lbs.
W 736.	South Kanara (Cherry)	39
W 4611.	Travancore (Bourdillon)	38

2. **M. laurifolia**, Hook. f. and Th.; Fl. Br. Ind. v. 103 (part); King Ann. Calc. iii. 290; Trimen Fl. Ceyl. iii. 434. Vern. *Malam padavu, palmanikam*, Tam.; *Patthapanu*, Kader; *Malaboda*, Cingh.

An evergreen tree. *Wood* reddish-brown, structure resembling that of *M. malabarica*.

Ceylon only, according to King; Travancore (Bourdillon).

Bourdillon gives W = 34 lbs., P = 356. There is some doubt about this, but Bourdillon's botanical accuracy is so well known that I can only accept his determination, and more especially as Trimen also refers to it as South Indian. Mendis says the wood is used for coffee and plumbago casks, coffins and packing-cases.

		lbs.
W 4547.	Travancore (Bourdillon)	35
No. 89,	Ceylon Collection, new (Mendis)	—

3. **M. Beddomei**, King Ann. Calc. iii. 291. *M. laurifolia*, Hook. f. and Th.; Fl. Br. Ind. v. 103 (part); Bedd. Fl. Sylv. t. 267; Talbot Bomb. List 165. Vern. *Jajikai*, Kan.; *Jayaphal*, Mar.

A large evergreen tree. *Wood* light reddish-brown, moderately hard, with prominent regular concentric lines like annual rings. *Pores* moderate-sized, usually subdivided radially into 2 or 3, or in short strings in echelon, rather scanty. *Medullary rays* fine, numerous, irregular.

Western Gháts from the Konkan southwards and in Ceylon, rising to 5000 ft.

A conspicuous and fairly common tree on the western slopes of the Nilgiris. Trimen says the wood is used for tea-boxes in Ceylon.

		lbs.
W 4605.	Travancore (Bourdillon)	54

4. **M. magnifica**, Bedd. Fl. Sylv. t. 268; Fl. Br. Ind. v. 104; King Ann. Calc. iii. 291. Vern. *Ramanadike*, Kan.; *Chúra pannu*, Tam.; *Chúra payin*, Mal.

A very large evergreen tree with large buttresses to the stem. *Bark* dark reddish-brown. *Wood* light reddish-brown, streaked, soft, with many prominent brown concentric lines like annual rings. *Pores* moderate-sized, in short radial strings of two and three. *Medullary rays* very numerous, fine, brown.

Tinnevelly and Travancore Hills, at the foot of the Gháts.

Bourdillon gives W = 30 lbs., P = 375. It is a scarce tree, very little known, but very handsome.

		lbs.
W 4294.	Tinnevelly (Brasier)	31
W 4548.	Travancore (Bourdillon)	29

5. **M. canarica**, Bedd.; King Ann. Calc. iii. 307. *M. Farquhariana*, Wall.; Fl. Br. Ind. v. 108 (part); Bedd. Fl. Sylv. t. 270; Talbot Bomb. List 165. Vern. *Pindi*, Kan.

An evergreen tree. *Wood* structure the same as that of *M. Beddomei*, but the wood softer and lighter.

Western Gháts from the Konkan southwards, Coorg and the Wynaad.

Bourdillon gives W = 34 lbs., P = 409.

		lbs.
W 4615.	Travancore (Bourdillon)	34

6. **M. Kingii**, Hook. f.; Fl. Br. Ind. v. 106; King Ann. Calc. iii. 300; Gamble Darj. List 64.

A small tree. *Wood* reddish-brown, smooth, moderately hard, with regular rings of hard wood which probably represent *annual rings*. *Pores* moderate-sized, scanty, often subdivided, fairly regularly arranged. *Medullary rays* moderately broad, wavy, giving a neat silver-grain.

Low valleys in the Sikkim Himalaya at 1–2000 ft.; Mikir Hills, Assam and Cachar.

		lbs.
E 5107.	Tista Valley, Darjeeling (C. G. Rogers)	38

7. **M. Irya**, Gaertn.; Fl. Br. Ind. v. 109; King Ann. Calc. iii. 309; Bedd. Fl. Sylv. clxxvi.; Kurz For. Fl. ii. 282; Trimen Fl. Ceyl. iii. 485. Vern. *Maloh*, Burm.; *Mutwindá, chualam*, And.; *Iriya*, Singh.

A moderate-sized evergreen tree. *Bark* purplish-grey, smooth. *Wood* dark olive-grey, hard, close-grained. *Annual rings* marked by distinct lines. *Pores* moderate-sized and large, oval and subdivided, uniformly distributed. *Medullary rays* numerous, very fine, wavy, bent outwards where they touch the pores, prominent on a radial section; the distance between the rays smaller than the transverse diameter of the pores.

Burma, Andaman Islands and Ceylon.

A handsome wood worthy of attention; it seasons well and takes a good polish. Heinig says it squares up to 40 ft. in length, 2 ft. in siding.

		lbs.
B 509.	Andaman Islands (General Barwell)	52

8. **M. attenuata,** Wall.; Fl. Br. Ind. v. 110; King Ann. Calc. iii. 316; Bedd. Fl. Sylv. clxxvi.; Talbot Bomb. List 165. *M. corticosa*, Bedd. Fl. Sylv. t. 271. Vern. *Rukt mara*, Kan.; *Chenalla*, Mal.: *Pánu, karayan, undipánu*, Trav. Hills.

A tall tree. *Wood* light reddish-brown, soft. *Pores* small to moderate-sized, subdivided radially, scanty. *Medullary rays* fine, not numerous. Concentric lines less clearly marked than in other species.

Evergreen forests of the Western Coast from the Konkan southwards.

Bourdillon gives W = 35 lbs., P = 514.

		lbs.
W 4595.	Travancore (Bourdillon)	35

ORDER XCII. MONIMIACEÆ.

1. HORTONIA, Wight.

Two species. *H. angustifolia*, Trim.; Trimen Fl. Ceyl. iii. 437, t. 78, is a scarce shrub of the moist low country of Ceylon.

1. **H. floribunda,** Wight; Fl. Br. Ind. v. 115; Bedd. Fl. Sylv. clxxvii.; Trimen Fl. Ceyl. iii. 436. Vern. *Wawiya*, Cingh.

A shrub. *Wood* white, soft, cuts easily. *Pores* small, fairly numerous, regular. *Medullary rays* broad, at irregular distances with fine ones between: silver-grain of long shallow horizontal plates.

Hill forests of Ceylon at 4–7000 ft.

Ceylon: Int. Exhibition, 1862—Kew Museum.

ORDER XCIII. LAURACEÆ.

This large Family contains many forest trees, some of them of considerable importance, producing such valuable articles as cinnamon and camphor. Owing, however, to the flowers being usually diœcious, and it being consequently not always possible to secure specimens of both sexes and fruits as well as flowers, few Orders have been so difficult to describe and arrange. Then, too, the flowers are rather small and the anther-characters difficult to make out in dried specimens, while even in growing plants in the forest it is by no means easy to recognize the species, especially in genera like *Machilus* and *Litsea*.

There are 15 genera, belonging to three Tribes, viz.—

Tribe I. Perseaceæ . . .	Cryptocarya, Apollonias, Beilschmiedia, Dehaasia, Endiandra, Syndiclis, Cinnamomum, Machilus, Phœbe, Alseodaphne.
„ II. Litseaceæ	Actinodaphne, Litsea, Dodecadenia, Lindera.
„ III. Hernandieæ . . .	Hernandia.

The Bay Laurel of Europe is *Laurus nobilis*, Linn. The Avocado pear is the fruit

so much valued in China for coffins is *Persea Nan-muh*, Oliv. (No. 3259—*wood* soft, aromatic, dark olive-brown, with small *pores* and fine *medullary rays*). The Sassafras tree of North America is *Sassafras officinale*, Nees (No. 2962—*wood* soft, porous, strongly scented, with rather broad *medullary rays*). The Stinkwood tree of the Cape giving a valuable timber is *Ocotea bullata*, N. ab E.

The well-known and valuable timber "Greenheart" is the produce of *Nectandra Rodiœi*, Rob. Schomb. of Demerara. It is in considerable use for piles, and was formerly valued for shipbuilding (No. 2961—68 lbs. per cubic foot; *wood* dark brown, very hard and heavy; *pores* moderate-sized, often filled with yellow resin, scanty; *medullary rays* fine, uniform, equidistant, but few). Laslett gives W = 72 lbs., P = 1000.

The *wood* of the Indian laurels is generally light-coloured, soft or moderately hard, without heartwood, even-grained, seasoning well without splitting. They have, with few exceptions, a uniform structure. *Pores* small or moderate-sized, uniformly distributed, sometimes scanty. *Medullary rays* fine, uniform and equidistant. *Annual rings* distinctly marked in most species. *Hernandia* wood differs in texture and in structure from all the rest.

Tribe I. PERSEACEÆ.

1. CRYPTOCARYA, Brown.

Ten species, all evergreen trees or shrubs of the moister regions of India. *C. amygdalina*, Nees; Fl. Br. Ind. v. 118; Gamble Darj. List 64; Vern. *Patmero*, Nep.; *Kaledzo*, Lepcha, is a tree of the Eastern Himalaya from Nepal to Assam, the Khasia Hills and Sylhet. *C. Griffithiana*, Wight; Kurz For. Fl. ii. 295, and *C. Kurzii*, Hook. f. (*C. ferrea*, Kurz For. Fl. ii. 295) are trees of Tenasserim; and *C. Andersoni*, King; Fl. Br. Ind. v. 120, a tree of Assam, of which but very little is known. *C. andamanica*, Hook. f., *C. Ferrarsi*, King and *C. cœsia*, Bl. are trees of the Andaman Islands.

In South India and Ceylon there are two species besides *C. Wightiana*, Thw. *C. Stocksii*, Meissn.; Fl. Br. Ind. v. 120; Talbot Bomb. List 166, is a large but scarce tree of the Western Ghâts, chiefly found about Sispara in the Nilgiri Hills and in the Anamalais. *C. membranacea*, Thw.; Fl. Br. Ind. v. 120; Bedd. Fl. Sylv. clxxxv.; Trimen Fl. Ceyl. iii. 439; Vern. *Tawenna*, Cingh., is an endemic Ceylon tree of the moist low country and up to 2000 ft., having a heavy close-grained greyish-yellow wood.

1. **C. Wightiana,** Thw.; Fl. Br. Ind. v. 120; Bedd. Fl. Sylv. t. 299; Talbot Bomb. List 166; Trimen Fl. Ceyl. iii. 439. Vern. *Gulmur*, Kan.; *Galmora*, Cingh.

A large evergreen tree. *Wood* moderately hard, pale brownish-yellow. *Pores* moderate-sized, regularly distributed, thick- and pale-walled. *Medullary rays* fine, regular.

Forests of the Western Ghâts and Western Coast from the Konkan southwards; moist region of Ceylon up to 5000 ft.

Ceylon: Int. Exhibition, 1862—Kew Museum.

2. APOLLONIAS, Nees. *A. Arnottii*, Nees; Fl. Br. Ind. v. 121; Bedd. Fl. Sylv. t. 291; Brandis For. Fl. 377; Vern. *Chenthanam*, Trav. Hills, is a tree of the Western Ghâts from the Nilgiris to Travancore and Tinnevelly. It affects the damp forests of the slopes and is found as high up as 6000 ft. at Sispara. Bourdillon calls it a "lofty tree," but the few specimens I have seen have been quite small.

3. BEILSCHMIEDIA, Nees.

Eleven species, of which 3 in North-Eastern Himalaya, 4 in Assam, 3 in Burma, 2 in Western or Southern India, and 1 in Ceylon.

In Ed. 1 the woods sent from Assam and Sikkim under the name of *B. Roxburghiana* were put together and described under that species. It is probable that the

Assam specimens were right, but as regards the Sikkim specimens Hooker has suggested that they probably belong to *B. sikkimensis*, and this identification for the well-known "*Tarsing*" I propose to accept for the present, though my specimens do not fully agree with the descriptions. I have leaf-specimens of what I believe to be a *Beilschmiedia* from various places in the hills of the Eastern Ghâts, Mahendragiri, Palkonda, Rumpa, but I have failed to identify it with any of the described species, though I think it may be *B. fagifolia*, var. *Dalzellii*.

B. fagifolia, Nees; Fl. Br. Ind. v. 122, is a tree of Sylhet; its var. *Dalzellii*, Meissn. (*B. fagifolia*, Bedd. Fl. Sylv. t. 263; Brandis For. Fl. 379; Talbot Bomb. List. 167) is an evergreen very large tree of the forests of the Western Ghâts, extending from the Konkan to S. Kanara and giving a "very good timber, used for building 'purposes" (Bedd.). *B. Clarkei*, Hook. f.; Fl. Br. Ind. v. 122, is a large tree of inner Sikkim valleys at 4500 ft. *B. Gammieana*, King; Fl. Br. Ind. v. 124, is a small tree of the frontier range of Sikkim and Nepal, found on the northern slopes of Phalút at 6000 ft. *B. Brandisii*, Hook. f. and *B. assamica*, Meissn. are trees of Assam; while *B. macrophylla*, Meissn. and *B. globularia*, Kurz For. Fl. ii. 294 are trees of Burma, the former of Tenasserim, the latter of the drier Martaban Hills at 3–4000 ft.

B. Wightii, Benth.; Fl. Br. Ind. v. 124 (*Haasia Wightii*, Nees; Bedd. Fl. Sylv. t. 298), is a tree of the Anamalai, Travancore and Tinnevelly Hills in S. India. *B. oppositifolia*, Benth.; Fl. Br. Ind. v. 124 (*B. zeylanica*, Trimen Fl. Ceyl. iii. 440. *Haasia oppositifolia*, Bedd. Fl. Sylv. clxxxiv.), is a large tree of the lower Ceylon hills at 3–4000 ft.

1. B. **Roxburghiana**, Nees; Fl. Br. Ind. v. 121; Kurz For. Fl. ii. 293. *Laurus bilocularis*, Roxb. Fl. Ind. ii. 311. Vern. *Serai gúti*, Ass.; *Shawdu*, Burm.

An evergreen tree. *Wood* white, moderately hard, even-grained, heartwood streaked with red. *Pores* moderate-sized, scanty, oval and subdivided. *Medullary rays* variable, very fine to moderately broad, numerous.

Assam, Tippera, and Tenasserim.
The wood is reported to be used for boats in Assam.

		lbs.
E 1258, 1264.	Tezpur, Assam	36 and 39
	Nordlinger's Sections, vol. 10.	

2. B. **sikkimensis**, King; Fl. Br. Ind. v. 122; Gamble Darj. List 64. *B. Roxburghiana*, Nees; Brandis For. Fl. 378, *probably* see Fl. Br. Ind. Vern. *Konháiah*, Oudh; *Tarsing*, Nep.; *Kanyu*, Lepcha.

A large evergreen tree. *Wood* brownish-white, soft. *Pores* moderate-sized to large, very scanty, single or in small groups, surrounded by loose tissue. *Medullary rays* moderately broad, long, scanty. Concentric lines which may be annual rings many, prominent.

Hills of Sikkim and Bhutan, probably up to 8000 ft., certainly to 6500 ft. (Manson in "Darj. Working Plan"); extending probably to Oudh and Kumaon.

A fine large tree, common in the Darjeeling forests and with a useful wood used for building, tea-boxes, etc. Growth moderate, 5 to 9 rings per inch of radius.

		lbs.
E 700.	Chuttockpúr Forest, Darjeeling, 6000 ft. (Johnston) . . .	35
E 2419.	Rangbúl " " 7000 ft. (Gamble) . . .	36
E 3593.	Darjeeling, 6000 ft. (Gamble)	—

No. W 4590 from Travancore, sent by Bourdillon, is named *B. fagifolia*, but the wood is so unlike that of *B. Roxburghiana* and *B. sikkimensis* that I cannot but feel doubtful about it. It is hard and heavy, light brown in colour, has small *pores* surrounded by white rings and arranged in broken radial lines between the fine pale *medullary rays*. Where there are no pores the rays are connected by fine irregularly spaced cross-bars of the same colour. Weight 51 lbs, per cubic foot.

Nos. E 1290, Vern. *Dumbail*, 31 lbs., and E 1292, Vern. *Raun dolu*, 32 lbs., from Cachar, seem to belong to this genus, though the pores are larger than usual.

4. DEHAASIA, Blume. *D. cuneata*, Bl.; Fl. Br. Ind. v. 125 (*Alseodaphne grandis*, Kurz For. Fl. ii. 293), is an evergreen tree of the tropical forests of Burma with a yellowish wood, rather heavy but loose-grained (Kurz). *D. Kurzii*, King; Fl. Br. Ind. v. 125, and *D. elongata*, Bl. are trees of the Andaman Islands, the former extending to Tenasserim.

5. ENDIANDRA, Br. *E. firma*, Nees; Fl. Br. Ind. v. 126, is an evergreen tree of Sylhet and Cachar.

6. SYNDICLIS, Hook. f. *S. paradoxa*, Hook. f.; Fl. Br. Ind. v. 127, is a tree of Bhutan. It is interesting as being the only one of the Order with 1-celled anthers: it was discovered by Mr. Booth (see "Fl. Br. Ind.").

7. CINNAMOMUM, Blume.

About 24 species, divided into two subgenera—MALABATHRUM with 20, CAMPHORA with 4 species.

Subgenus 1. MALABATHRUM. *C. Cassia*, Bl.; *C. nitidum*, Bl. and *C. tavoyanum*, Meissn., are Burmese trees, the first from Upper Burma, the others from Tenasserim. *C. multiflorum*, Wight, *C. ovalifolium*, Wt., and *C. litseæfolium*, Thw. are Ceylon trees, the first-named (*Wal-kurundu*, Cingh.) being common in the lower region, the others found in the hills. *C. sulphuratum*, Nees; Fl. Br. Ind. v. 132, is a handsome yellowish-looking tree of the Nilgiri sholas, where it is common. *C. Wightii*, Meissn. is also found in the Nilgiri Hills; *C. macrocarpum*, Hook. f.; Talbot Bomb. List 167, in North Kanara; and *C. gracile*, Hook f. on river-banks in Travancore and Tinnevelly. *All the above-mentioned species have opposite leaves and are triple-nerved. Of those* with triple-nerved alternate leaves, *C. caudatum*, Nees; Fl. Br. Ind. v. 134; Kurz For. Fl. ii. 289; Gamble Darj. List 65; Vern. *Kharsoni*, Nep.: *Sanging*, Lepcha, is a tree of the lower hills of Sikkim up to 5000 ft., and the Kakhyen Hills in Burma; and *C. Perrottetii*, Meissn. is a small species of the Nilgiris. *C. citriodorum*, Thw.; Fl. Br. Ind. v. 134; Trimen Fl. Ceyl. iii. 443; Vern. *Pengiri-Kurundu*, Cingh. is a scarce tree of the moist low country of Ceylon, with a yellowish wood and leaves and bark scented with lemon and cinnamon. It has penni-veined subopposite leaves. *C. vimineum*, Nees; Fl. Br. Ind. v. 131, has been found in the Shan Hills at 3000 ft.

Subgenus 2. CAMPHORA. *C. glanduliferum*, Meissn.; Fl. Br. Ind. v. 135; Brandis For. Fl. 376; Vern. *Malligiri*, *marisgiri*, Nep., is a tree of the Central Himalaya extending west to Kumaon, and of the Khasia Hills. Its wood is strongly scented with camphor. The plant described in Ed. 1 under this name is apparently the neighbouring *C. cecicodaphne*, but some of the wood specimens may perhaps belong to *C. glanduliferum*. *C. Parthenoxylon*, Meissn.; Fl. Br. Ind. v. 135; Kurz For. Fl. ii. 289 (*Laurus porrecta*, Roxb. Fl. Ind. ii. 308) is a large tree of Tenasserim, which gives, according to Kurz, the "Martaban camphor-wood." It may be the one herein mentioned as *Sinkozi*, Burm.

The Japan camphor tree is *C. Camphora*, Nees and Eberm.; the Cassia cinnamon tree of China is probably *C. Cassia*, Bl., which apparently just passes into the Indian region in Upper Burma.

Wood soft, seasons well, and does not warp or crack. *Pores* variable in size, usually moderate-sized, rather scanty, and surrounded by loose tissue, well marked on a longitudinal section. *Medullary rays* uniform and equidistant. The leaves and bark, as well as the wood of many species, are aromatic.

1. **C. Tamala,** Nees; Fl. Br. Ind. v. 128; Brandis For. Fl. 374; Gamble Darj. List 64. *Laurus Cassia*, Roxb. Fl. Ind. ii. 297. Cassia Lignea or Cassia Cinnamon. Vern. *Dálchíni*, *kirkiria*, *kikra*, *sinkami*, *silkanti*, Hind.; *Gurandra*, Jaunsar; *Chota sinkoli*, Nep.; *Nupsor*, Lepcha; *Dopatti*, Ass.

A moderate-sized evergreen tree. *Bark* thin, compact, brown, wrinkled, with an aromatic taste. *Wood* reddish-grey, splits and warps, moderately hard, close-grained, slightly scented. *Annual rings* distinctly marked by a narrow belt of firmer wood on the

outer edge with fewer pores. *Pores* small to moderate-sized. *Medullary rays* fine, numerous, equidistant.

Himalaya, sparingly from the Indus to the Sutlej, common thence in shady places along streams to Bhutan, rising to 7000 ft., but most common at 3–5000 ft.; Sylhet and the Khasia Hills at 3–4000 ft.; often cultivated in gardens in N. India.

When well-grown the Cassia Cinnamon is a handsome tree, on account of its glossy 3-nerved leaves, pink young foliage, and panicles of yellowish-white flowers. The leaves are aromatic with the scent of cinnamon. They are commonly known by the name of *tezpat* or *tejpat*, and are used in medicine, also to flavour curries. The bark is also used as a substitute for, or an adulterant of, the true cinnamon. It used to be, with that of *C. impressinervium*, collected largely in the Darjeeling Forests and exported, but I believe the demand has fallen, and forest regulations probably may have interfered to restrict the sale of a product the collection of which by the purchasers is likely to be wasteful. It is called *Taj* in Northern Bengal.

The wood is not used. Its rate of growth varies from 6 to 10 rings per inch. The trees in the West Himalaya are often attacked by a curious fungus which causes a large fleshy kind of "witches' broom," and which is *Exobasidium Cinnamomi*, Massee. ("Ind. For." xxi. 133 and xxv. 438).

		lbs.
H 937.	Hazara, 4000 ft. (Baden-Powell)	40
H 3162.	Dungagalli, Hazara, 4000 ft. (Wild)	—
H 427.	Bhagiár Forest, Jaunsar, 4000 ft. (Bagshawe)	35

2. **C. obtusifolium**, Nees; Fl. Br. Ind. v. 128; Brandis For. Fl. 375; Kurz For. Fl. ii. 287; Gamble Darj. List 65. *Laurus obtusifolia*, Roxb. Fl. Ind. ii. 302. Vern. *Tezpat, ramtezpat, kinton*, Beng.; *Phatgoli*, Kumaon; *Katkaula*, Garhwal; *Dalchini kaulo*, Dotiál; *Bara singoli*, Nep.; *Nupsor*, Lepcha; *Patihonda*, Ass.; *Dupatti*, Mechi; *Krowai*, Magh; *Lulingyaw*, Burm.

An evergreen tree. *Bark* grey, aromatic, ¼ in. thick. *Wood* reddish-grey, moderately hard, shining. *Annual rings* very indistinctly marked. *Pores* moderate-sized, often subdivided, uniformly distributed in frequently grouped oblique lines, the groups surrounded by loose tissue; when wetted a gum exudes. *Medullary rays* moderately broad, short, slightly undulating, prominent as long narrow plates in the silver-grain.

Outer Eastern Himalaya to 7000 ft.; Assam, Khasia Hills, Eastern Bengal, Burma and Andaman Islands.

Growth moderate, the specimens show 10 to 12 rings per inch of radius; a tree examined by J. C. McDonell near Darjeeling gave 15¼ rings per inch of radius. S. E. Peal says that it gives very good wood for tea-boxes and for planking of all sorts, but that so far it is only used in Assam for charcoal (*Ind. Tea Gaz.*). The leaves are aromatic, and the bark, especially that of the roots, resembles cinnamon. The "Muga" silkworm (*Antheræa Assama*) sometimes feeds on its leaves.

		lbs.
E 498.	Sukna Forest, Darjeeling Terai (Manson)	44
E 693.	Sepoydura Forest, Darjeeling, 5500 ft. (Johnston)	38

Nordlinger's Sections, vol. 9 (*Laurus obtusifolia*).

3. **C. impressinervium**, Meissn.; Fl. Br. Ind. v. 129; Gamble Darj. List 65. Vern. *Sinkoli*, Nep.; *Nupsor*, Lepcha.

A small evergreen tree. *Bark* and *wood* resembling that of *C. Tamala*.

Sikkim Himalaya at 4–6000 ft.

All my Darjeeling Herbarium specimens of "Tezpat" seem to belong to this species, and not to *C. Tamala*, and I think the wood specimens also belong here. I have no doubt that the bark is used indiscriminately with that of *C. Tamala*.

		lbs.
E 575.	Sukna Forest, Darjeeling Terai (Manson)	42

4. C. pauciflorum, Nees; Fl. Br. Ind. v. 129. Vern. *Dinglatterdop*, Khasia.

Wood light red, very aromatic, rough, hard. *Pores* moderate-sized, often in radial lines. *Medullary rays* moderately broad numerous, with a good silver-grain.

Assam Valley, Khasia Hills and Sylhet.
Growth fast, 4 rings per inch of radius.

		lbs.
E 798.	Khasia Hills, 5000 ft. (G. Mann)	39

5. C. iners, Reinw.; Fl. Br. Ind. v. 130; Kurz For. Fl. ii. 287. *Laurus nitida*, Roxb. Fl. Ind. iii. 300. Vern, *Hmanthin*, Burm.

A large tree. *Bark* grey, smooth, with horizontal wavy bands, ¼ to ½ in. thick. *Wood* light yellowish-brown, moderately hard, shining, smooth, scented. *Pores* moderate-sized, often subdivided, surrounded by loose tissue, frequently filled with resin. *Medullary rays* short, fine, prominent, not deep, causing a speckled silver-grain on a radial section.

Forests of South Tenasserim.

An important wood, scented like that of *C. cecicodaphne* and other species, and likely to be valuable for export if obtainable in large quantities and cheap.

		lbs.
B 1946, 2482.	Tavoy (Seaton)	43 and 36
B 4072.	Tenasserim (Palmer)	37
B 4931.	Tavoy (Manson)	—

6. C. zeylanicum, Breyn; Fl. Br. Ind. v. 131; Bedd. Fl. Sylv. t. 262; Brandis For. Fl. 375; Kurz For. Fl. ii. 287; Talbot Bomb. List 167; Trimen Fl. Ceyl. iii. 440. *Laurus Cinnamomum*, Roxb. Fl. Ind. ii. 295. The Cinnamon. Vern. *Dalchini*, Hind.; *Karruwa, lalsingh, lavunga*, Tam.; *Ohez, bojewar*, Mar.; *Sanalinga*, Tel.; *Eringolam, elavangam, vayana*, Mal.; *Lavanga*, Trav. Hills; *Kurundu*, Cingh.; *Thitkyabo*, Burm.

A large tree. *Bark* brown, rough, ½ to ¾ in. thick. *Wood* light red, moderately hard. *Pores* moderate-sized, often subdivided, surrounded by open tissue often of darker colour. *Medullary rays* fine, brown, bent where they touch the pores, giving a shining silver-grain on a radial section.

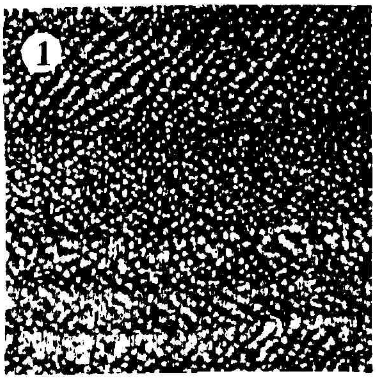
South and West India, along the coast from the Konkan southwards, rising on the Ghât slopes to 6000 ft.; moist low country of Ceylon up to 2000 ft.; Tenasserim in Burma.

This is the wild plant of the true cinnamon. The spice is given by the bark, but the leaves also are aromatic, and the root yields camphor. Trimen says that the cinnamon has doubtless been collected in Ceylon from the very earliest times, for it is referred to by Ibn Batuta in the 14th and Nicolo Conti in the 15th century. The cinnamon gardens of Colombo and Galle and the South-West Coast generally are stretches of coppice growth in which the tree is not allowed to grow large, and the shoots which are large enough for bark are cut out yearly in a sort of "furetage." The bark is cleaned of the outer rough layers, and the rest allowed to roll into quills, in which form it goes into the markets (see also Brandis For. Fl. 375). In the times of the Portuguese and Dutch in Ceylon, the cultivation of cinnamon was a Government monopoly, and the British Government also maintained the monopoly until 1833. According to W. E. Davidson (Ceylon Official Handbook, Paris Exhibition, 1900), the area under cultivation in Ceylon is about 43,500 acres, and the value of the export trade about 25 lakhs of rupees, the best quality fetching 1*s*. 3*d*. per pound. The value of the trade in India is much less, scarcely reaching Rs.10,000 (Watt).

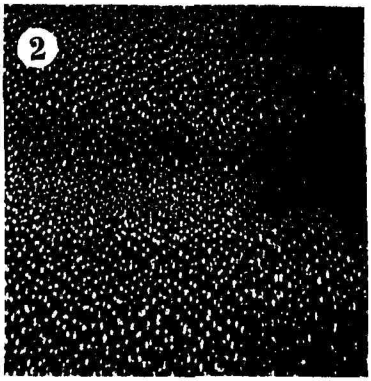
The wood is not used; it is somewhat scented, but coarse. Bourdillon gives W = 37 lbs., P = 593.

According to Foulkes it grows on any soil, but best perhaps on laterite. He says the fruits are collected unripe and exported to Bombay to adulterate cloves. A medicinal oil is also obtained from them.

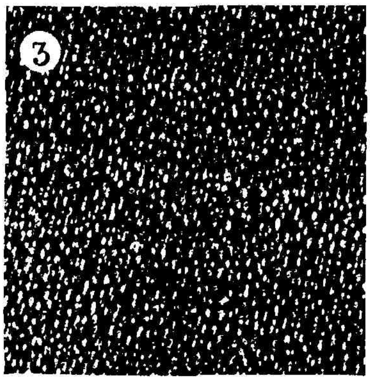
XII.



CINNAMOMUM CECICODAPHNE.



LITSÆA POLYANTHA.



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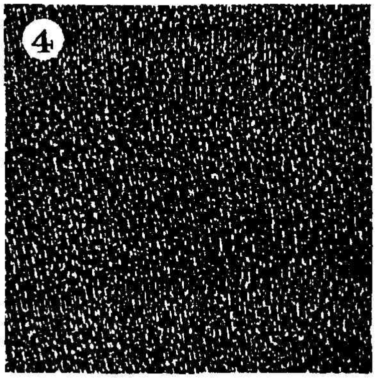

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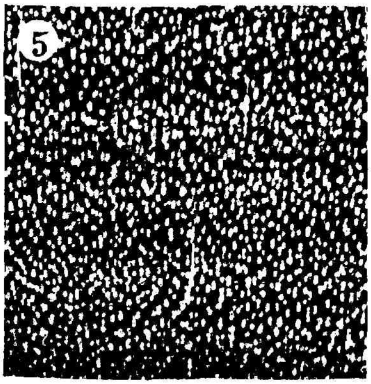
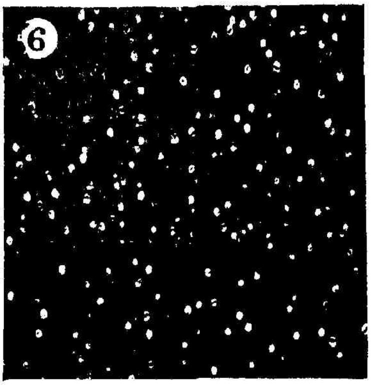


BISCHOFIA JAVANICA.



CROTON ARGYRATUS.

(Magnified 3½ times.)

		lbs.
W 3884.	Aramby Reserve, Nilgiris, 7000 ft. (Gamble)	40
W 4549.	Travancore (Bourdillon)	43

Ceylon Collection, new, No. 81 (Mendis).
Nordlinger's Sections, vol. 10 (*Laurus Cinnamomum*).

I believe the Aramby specimen to be correct, but it *might* belong to *C. sulphuratum*, which is a more common tree in the higher sholas.

7. C. cecicodaphne, Meissn.; Fl. Br. Ind. v. 135; Gamble Darj. List 65. Vern. *Malligiri, marisgiri*, Nep.; *Rohu*, Lepcha; *Gunserai*, Mechi; *Gondhori, gondri, gondserai*, Ass.; *Gundroi*, Cachar.

A large tree. *Bark* 1 to 2 in. thick, dark grey, uneven, outside corky, highly scented. *Wood* rough, pale brown, highly scented with a strong smell of camphor, soft to moderately hard, even-grained. *Annual rings* marked by a distinct line. *Pores* between moderate-sized and large, uniformly distributed, often oval and subdivided and filled with a glittering resinous substance, distinctly marked on a vertical section. *Medullary rays* short, numerous, uniformly distributed, fine or moderately broad, the distance between the rays generally less than the transverse diameter of the pores.

Eastern Himalaya in Sikkim and Bhutan, rising to 4000 ft.; Assam and Sylhet.

This tree has hitherto been called *C. glanduliferum*, to which species indeed some of our specimens may belong, and of which, as suggested by Hooker, it may prove to be a form, but as far as I can make out, the Darjeeling and Assam tree is *C. cecicodaphne*. There are fine specimens growing in the Park and the Kaunli garden at Dehra Dún grown from Assam seed, said to have been obtained by W. R. Fisher, and these seem certainly to belong to *C. cecicodaphne*, and prove that it is well worthy of cultivation, not merely for its scented wood, but for its ornamental character. The leaves turn red before they fall. S. E. Peal says it reaches a girth of 8 to 10 ft., and occasionally is large enough to make canoes capable of carrying from 300 to 500 mds. The scent precludes the use of the wood for tea-boxes, but it is good for boxes and furniture, as white ants dislike it. It is somewhat brittle, however, as I have found with some which I have had for several years in India, made into herbarium boxes. The growth of the tree is fast, 2 to 3 rings per inch of radius. The weight is about 38 lbs. per cubic foot.

		lbs.
E 670.	Dulka Jhar, Darjeeling Terai (Manson)	38
E 2413.	Tista Valley, Darjeeling (Gamble)	37
E 628.	Eastern Dúars, Assam (G. Mann)	39
E 639, 2304.	Kámrúp, Assam (G. Mann)	34 and 40
E 2187.	Nowgong „	44

Nordlinger's Sections, vol. 9 (*Laurus glandulifera*, Wall.) (Tab. XII. 1).

8. C. inunctum, Meissn.; Fl. Br. Ind. v. 135; Kurz For. Fl. ii. 289. Vern. *Karaway*, Burm.

Wood orange-brown, scented, moderately hard, oily to the touch. *Pores* moderate-sized and large, often subdivided, filled with resin, the transverse diameter often equal to, or slightly larger than, the distance between the fine, prominent, *medullary rays*. The rays give a good silver-grain. It resembles the wood of *C. cecicodaphne* in structure.

South Tenasserim.

Weight 42 lbs. per cubic foot. Wood durable, used for house-building and shingles, but not nearly so strongly scented as that of *C. iners, C. glanduliferum* and *C. cecicodaphne*. On a radial section dark specimens are not at all unlike Teak.

		lbs.
B 1945, 2483.	Tavoy (Seaton)	43 and 46
B 4074.	Tavoy (C. E. Palmer)	38

9. C. sp. Vern. *Sinkozi*, Burm.

Wood red, soft, strongly scented. *Pores* moderate-sized, often subdivided, their transverse diameter generally equal to, or less than, the distance between the short and fine *medullary rays*.

South Tenasserim.

The tree was found by the late Mr. Lee in Mergui, but is rather scarce. It may possibly be *C. tavoyanum* or *C. Parthenoxylon*.

		lbs.
B 1387.	Tavoy	41

B 4932 from Tavoy; Vern. *Thitlainyin*, received from F. B. Manson, Conservator, is a wood with a strong scent of cloves. The bark chewed has exactly the same effect as cloves. It is a species of *Cinnamomum*, with 3-nerved leaves.

Bark shining, brown, with long shallow vertical furrows. *Wood* light brown, moderately hard. *Pores* moderate-sized, evenly distributed. *Medullary rays* fine, numerous.

Nos. B 298, Burma (1867), 24 lbs.; B 2691 (40 lbs.); B 2695 (39 lbs.); B 2719 (36 lbs.), Tavoy (Wallich, 1828), all evidently belong to Lauraceæ and probably to the genus *Cinnamomum*. They have light, soft, aromatic woods. *Pores* moderate-sized, generally subdivided. *Medullary rays* fine, equidistant, numerous.

10. C. Camphora, Nees and Eberm.; Brandis For. Fl. 376. *Laurus camphorifera*, Kaempfer; Roxb. Fl. Ind. ii. 304. The Japan Camphor tree.

A moderate-sized tree, usually branching early. *Bark* brown, rough. *Wood* greyish-white, moderately hard, scented strongly with camphor, rather rough. *Annual rings* clearly marked by a dark line. *Pores* moderate-sized, rather scanty, often subdivided into 2 or 3, sometimes in a faint concentric arrangement. *Medullary rays* fine, numerous, short. On a radial section the wood often shows pretty waves, as does satinwood or maple.

China, Japan, Cochin-China, Formosa, much planted in India, where it grows admirably in suitable places.

This tree is that which gives the Japan camphor as distinct from the Malay or Borneo camphor given by *Dryobalanops Camphora*. The camphor is obtained by "boiling chips of the wood and roots with water, when the crude camphor is sublimed 'with the steam and deposited on straw with which the head of the retort is filled. 'It is afterwards purified by sublimation with lime or chalk" (Brandis). For a more detailed account "Ind. Forester," xix. 459 and xxiii. 469, may be consulted. According to a Report of the American Consul at Tamsin, Formosa, reproduced in the *Times* of Sept. 19, 1900, the annual outturn of camphor from Japan comes to 134 tons, that of China to 98 tons, while Formosa gives the enormous amount of nearly 2680 tons. The trade is a monopoly of the Japanese Government, who are using their endeavours to improve the quality of the product. Camphor is a very important and valuable product, used in medicine, to protect articles from insects, and generally as an antiseptic, in the manufacture of celluloid, smokeless powder, etc., and when it is remembered that India imports camphor yearly to the value of some seven lakhs of rupees, it is important that, if possible, she should be able to grow a supply of her own. This can easily be done with Japan camphor, which grows easily and quickly in many parts of India. There are fine trees in the Botanic Gardens of Calcutta and Saharanpur; it grows very well in Dehra Dún, and thrives even at the elevation of 7000 ft. in the Nilgiris. It requires good soil, but is very easily reared and planted. The growth is often very fast, some Dehra Dún specimens showing nearly 1 ring per inch of radius. The leaves can be used as well as the wood, as was found by Mr. D. Hooper's experiments ("Ind. Forester," xxii. 111). The extension of the cultivation of the tree seems certainly desirable, and there must be in various parts of India suitable places for it.

		lbs.
O 4498.	Forest School Park, Dehra Dún (Babu Birbal)	39
	Nordlinger's Sections, vol. 5 (*Laurus Camphora*).	

8. MACHILUS, Nees.

A very difficult genus, as is evidenced by the alterations which Sir Joseph Hooker had to make in his first account of it in the Fl. Br. Ind. The *M. odoratissima* of Ed. 1 "Manual of Indian Timbers" clearly contains something like 7 or 8 distinct species, and the wood specimens described under it belong to quite four species. I have gone over the genus again and again with great care, in the Herbaria of Kew and Calcutta, and I have dissected my own dried specimens, which to some extent correspond to specimens of wood in the various museums. After careful consideration, I am inclined to think that H 929 is *M. odoratissima*; H 92, *M. Duthiei*; E 435, 2414 and 3634; *M. Gammieana*; E 592, *M. Gamblei*; and E 1271, *M. bombycina*. The *Phœbe attenuata* of Ed. 1, p. 308, is undoubtedly *M. edulis*, E 363, 2416 and 3389. Of *M. macrantha* and *M. villosa* there is no reason to doubt.

About 16 good species are described in Fl. Br. Ind., but the genus still remains in some doubt, and requires to be fully studied from living specimens on the spot. Of those described, no less than 9 are Himalayan, about 9 Assamese or extending to Assam, 5 Burmese and 1 only South Indian. *M. odoratissima* extends west to the Indus; *M. Duthiei* and *M. Gamblei* to the Jumna or further; *M. villosa*, to Nepal; *M. edulis*, *M. Gammieana*, *M. Kurzii* and *M. bootanica* are Sikkim plants; *M. parviflora*, *M. Listeri*, *M. bombycina*, *M. khasyana* and *M. Kingii*, Assamese or Khasian; *M. fruticosa* and *M. rimosa*, Bl., Burmese; and *M. macrantha*, S. Indian.

M. parviflora, Meissn.; Fl. Br. Ind. v. 137, 860, is a common small tree of the Khasia Hills, where also are found *M. khasyana*, Meissn. and *M. Kingii*, Hook. f.; Fl. Br. Ind. v. 861, the latter a small tree common at 4–5000 ft. elevation, which is also found in the Shan Hills. *M. Listeri*, King; Fl. Br. Ind. v. 138, 860, is a tree of the Khasia Hills which probably extends east to Sikkim. *M. Kurzii*, King; Fl. Br. Ind. v. 860, is a large tree of the Darjeeling Hills at 6–9000 ft., and is probably the high-level *Kawala*. *M. bootanica*, Meissn.; Fl. Br. Ind. v. 138, 861, is a moderate-sized very distinct tree found by Griffith in Bhutan. *M. fruticosa*, Kurz For. Fl. ii. 292; Fl. Br. Ind. v. 140, 861, is a shrub of Upper Tenasserim at 4000 ft.

Wood soft or moderately hard, even-grained, usually smooth, grey or greyish-brown or reddish-brown. *Pores* moderate-sized or large, scanty, sometimes in patches, and often surrounded by loose tissue. *Medullary rays* fine to moderately broad, not numerous, usually giving a good silver-grain.

1. **M. odoratissima**, Nees (in part); Fl. Br. Ind. v. 139, 859; Brandis For. Fl. 378. *M. indica*, Kurz For. Fl. ii. 291. Vern. *Dalchini*, *mith-patta*, *prora*, *badror*, *leddil*, Pb.; *Kawala*, Hind.

A moderate-sized tree. *Bark* dark brown, thin, rough. *Wood* grey, moderately hard, with rather twisted grain, shining on a radial section. *Pores* moderate-sized, often subdivided, irregularly distributed and scanty. *Medullary rays* fine, not numerous, the distance between them equal to the diameter of the pores, giving a silver-grain of small plates.

Himalaya, from the Indus eastwards, at rather low levels, usually at 2–4000 ft.; Khasia Hills at 5–6000 ft.; hills of Martaban, 3–7000 ft.

This tree is recognized by its markedly oblong fruit and glabrous flower-panicles. It is scarce in the country about the Jumna and Sutlej, except quite low down; higher up it is replaced by the much more common *M. Duthiei*.

		lbs.
H 929.	Hazara, Punjab (Baden-Powell)	39
H 4894.	Mussoorie, N.-W. Provinces, 6000 ft. (Babu U. N. Kanjilal) .	42

2. **M. villosa**, Hook. f.; Fl. Br. Ind. v. 140, 860; Gamble Darj. List 65; *Phœbe villosa*, Wight; Kurz For. Fl. ii. 290. *Laurus villosa*, Roxb. Fl. Ind. ii. 310. Vern. *Surool*, Nep.; *Hlega*, Burm.

A large evergreen tree. *Bark* dark brown, rough. *Wood* yellowish-brown, moderately hard, of good texture, not unlike Teak, not liable to warp. *Annual rings* distinctly marked by a dark line *Pores*

moderate-sized, rather resinous. *Medullary rays* fine to moderately broad, rather distant, showing a good silver-grain on a radial section.

Eastern Himalaya, up to 7000 ft.; Assam, Sylhet, Cachar and the hill ranges across to Upper Burma.

A nice useful wood, but the growth is slow, 11 rings per inch of radius.

		lbs.
B 4751.	Upper Burma (J. Nisbet)	31

3. M. edulis, King; Fl. Br. Ind. v. 138, 860; Gamble Darj. List 65. Vern. *Dudri, lepchaphal, lepchakawala*, Nep.; *Phani*, Lepcha.

A large evergreen tree. *Wood* light greyish-brown, moderately hard, smooth, even-grained. *Annual rings* marked by a distinct line. *Pores* moderate-sized and large, often oval, often subdivided, scanty. *Medullary rays* fine, equidistant.

Sikkim and Bhutan Himalaya, at 4–8000 ft.

A conspicuous well-marked tree with a large round walnut-like fruit which is eaten by Lepchas, and long narrow leaves (called *Phœbe attenuata*, Nees in Ed. 1). It is an important tree in the Darjeeling Forests and reproduces admirably from seed. The wood is used for planking, tea-boxes and other purposes; its growth is moderate, 5 to 9 rings per inch of radius.

		lbs.
E 363.	Rangbúl Forests, Darjeeling, 7000 ft. (Johnston)	44
E 2416.	Chuttockpur Forest, Darjeeling, 6000 ft. (Gamble) . . .	39
E 3389.	Darjeeling Hills, 7000 ft.	—

4. M. Gammieana, King; Fl. Br. Ind. v. 137, 860; Gamble Darj. List 65. *M. Clarkeana*, King, Fl. Br. Ind. v. 137. Vern. *Lali, jagrikat*, Nep.; *Phamlet*, Lepcha.

A large tree. *Bark* dark brown. *Wood* reddish-brown, moderately hard, even-grained. *Pores* moderate-sized, surrounded by loose tissue and grouped in obliquely concentric patches, often filled with resin. *Medullary rays* fine to moderately broad, rather scanty.

Sikkim Himalaya, at 5–8000 ft.

A common tree in the Darjeeling Forests, important in their sylviculture, reproducing well from seed. The wood is used for planking, tea-boxes, etc., and its growth is moderately fast.

		lbs.
E 435.	Rangbúl Forest, Darjeeling, 7000 ft. (Johnston)	43
E 2414.	„ „ „ „ (Gamble)	36
E 3634.	Darjeeling, 7000 ft.	—

E 2414 is the specimen described, and I believe it to be correct, the others may possibly belong to another species. Nordlinger's Section, vol. 10 (*M. odoratissima*) seems to be this species.

5. M. Gamblei, King; Fl. Br. Ind. v. 138, 860; Gamble Darj. List 65. Vern. *Kawala*, Nep.

A moderate-sized tree. *Wood* reddish-brown with darker streaks, moderately hard, smooth, even-grained. *Pores* moderate-sized, in rings of loose tissue, joined into short obliquely concentric patches, prominent on a vertical section. *Medullary rays* fine, not numerous, showing a silver-grain.

Lower Himalaya from the Dehra Dún eastwards to Bhutan and the Daphla Hills at 2–4000 ft.; Assam Valley.

This is the low-level *Kawala*, and affects shady places in ravines and along streams.

		lbs.
E 592.	Khookloong Forest, Darjeeling Terai (Manson)	43

6. M. bombycina, King; Fl. Br. Ind. v. 861. Vern. *Soom*, Ass.

A moderate-sized tree. *Bark* brown, rough, at times greyish. *Wood* greyish-brown, in structure like that of *M. Gamblei*.

Assam Valley, especially in Sibságar District—largely cultivated.

In the Fl. Br. Ind. this species is given definitely as the Soom tree of Assam, and it is said to be cultivated only, but in Brandis' paper in "Ind. Forester," v. 35, written after a personal investigation of the *Muga* silk industry, it is said, "The Soom tree, on 'which the *Muga* silkworm is reared, is one of the commonest trees in the Sibságar 'District. It is found in almost all soils and situations, but is especially abundant on 'low marshy ground and in such places is exceedingly gregarious. It is not known if 'it is indigenous in the plains of Assam, but it is certain that it was largely cultivated 'in former times, and it is now firmly established in the district. At the present day, 'however (1880), it is seldom, if ever, planted, as existing forests are more than what 'is required, and a large proportion of them remain unutilized." For the system of production of *Muga* silk (the produce of *Antheræa assama*, Westw.) the rest of the article may be consulted, as well as vol. vi.–iii. of Dr. Watt's "Dictionary of Economic Products." S. E. Peal says that the felling of it is prohibited on waste lands, so that the wood is not much used, but it makes "uncommonly good tea-boxes—a little heavy, 'but very tough." He also mentions that, owing to the roots being entirely surface-feeders, it has to be completely dug out in clearing land for tea (*Ind. Tea Gaz.*).

		lbs.
E 1271.	Lakhimpur, Assam (G. Mann)	43

7. **M. Duthiei,** King; Fl. Br. Ind. v. 861. Vern. *Kawala*, Hind.; *Bhojo*, Jaunsar.

An evergreen tree. *Bark* thin, dark grey, slightly rough. *Wood* grey, moderately hard. *Annual rings* well marked by a dark line. *Pores* moderate-sized, rather scanty, evenly distributed. *Medullary rays* fine, not very numerous, causing a neat silver-grain.

Western Himalaya from Chamba eastwards to Nepal, and perhaps further, at 4–8000 ft.

A beautiful tree, shady and graceful and handsome, especially when in full flower. It prefers ravines and the banks of streams, and is easily recognized from *M. odoratissima* by having round fruit and tomentose flower-panicles. The wood is not used, but it is fairly good, though not durable. Growth slow.

		lbs.
H 92.	The Glen, Simla, 6000 ft. (Gamble)	37
H 4766.	Deota, Tehri-Garhwal, 8000 ft. (Gamble)	36

8. **M. macrantha,** Nees; Fl. Br. Ind. v. 140, 861; Bedd. For. Fl. t. 264; Brandis For. Fl. 378; Talbot Bomb. List 167; Trimen Fl. Ceyl. iii. 443. Vern. *Kurma*, Kan.; *Gulum*, Mar.; *Kolla mávu*, Tam.; *Urávu*, Mal.; *Ana kuru*, Trav. Hills; *Kromé*, Badaga; *Iruli*, Kader; *Ululu*, Cingh.

A large evergreen tree. *Wood* orange-brown, moderately hard. *Pores* moderate-sized, often subdivided. *Medullary rays* fine, rather irregular, scanty, the distance between them equal to the diameter of the pores.

Western Ghâts from the Konkan southwards, ascending to 7000 ft.; Ceylon up to 4000 ft.

Beddome says the timber is often used for building. Bourdillon gives W = 36 lbs. and P = 408, and says the wood is used for boats.

		lbs.
W 4585.	Travancore (Bourdillon)	34

9. PHŒBE, Nees.

Six species, evergreen trees or shrubs. *P. angustifolia*, Meissn.; Fl. Br. Ind. v. 141, is a small shrub of the Khasia Hills at 2–4000 ft. *P. pallida*, Nees; Fl. Br. Ind. v. 142; Brandis For. Fl. 377; Vern. *Kanwál*, Kumaon, is a small tree of the Central Himalaya from Kumaon to Sikkim ascending to 5000 ft., and of moist ravines in the Eastern Oudh forests. *P. attenuata*, Nees; Fl. Br. Ind. v. 143; Gamble Darj. List 65, is a tree of the Sikkim and Bhutan Himalaya, ascending to 4000 ft., and of the forests of Sylhet. *P. tavoyana*, Hook. f.; Fl. Br. Ind. v. 143 (*Machilus tavoyana*, Kurz For. Fl. ii. 292), is a tree of the Mergui Archipelago and Tavoy.

Wood smooth, even-grained, brown or olive-brown. *Pores* moderate-sized, scanty. *Medullary rays* fine, equidistant.

1. **P. lanceolata,** Nees; Fl. Br. Ind. v. 141; Brandis For. Fl. 377; Kurz For. Fl. ii. 290; Gamble Darj. List 65. *Laurus lanceolaria*, Roxb. Fl. Ind. ii. 309. Vern. *Chan, chandra, badror, shalanghi*, Pb.; *Haulia, dandora, káwal, sún kawal, bilphari*, Hind.; *Bhadroi*, Jaunsar; *Kat kawal, sunkaulo*, Kumaon; *Kekra, katkaulo*, Garhwal; *Wowolo*, Dotiál; *Tumri*, Dehra Dún; *Dupatti*, Mechi; *Nuni ajhar*, Gáro; *Sun kanwál*, Kumaon.

A small evergreen tree. *Wood* hard, close-grained: sapwood and young trees greyish-white, heartwood olive-brown. *Annual rings* marked by a distinct line. *Pores* moderate-sized, often oval and subdivided, or in short radial lines, uniformly distributed. *Medullary rays* fine, equidistant.

Outer Himalaya from the Sutlej to Bhutan, ascending to 6000 ft.; Khasia Hills, Sylhet and Burma.

A handsome tree, with a pretty wood. It seems doubtful if it is really found in S. India, so I have not quoted Beddome. Growth fast, 3 to 4 rings per inch of radius.

		lbs.
H 91.	Bhajji, Simla, 4000 ft. (Gamble)	46
E 2415.	Chunbati, Darjeeling, 2500 ft. (Gamble)	55
	Nordlinger's Sections, vol. 9.	

2. **P. paniculata,** Nees; Fl. Br. Ind. v. 142; Brandis For. Fl. 377. *P. Wightii*, Bedd. Fl. Sylv. t. 292. *P. pubescens*, Nees; Kurz For. Fl. ii. 290. Vern. *Kumára*, Badaga; *Taungkanyin*, Burm.

A moderate-sized tree. *Bark* thin, brown, slightly rough. *Wood* moderately hard: sapwood greyish-white, heartwood brown, smooth, with brown medullary patches. *Pores* moderate-sized, rather scanty, uniformly distributed. *Medullary rays* fine, equidistant.

Central Himalaya; Chittagong and Burma; Western Ghâts of S. India, especially the Nilgiris, up to 7000 ft.

A common tree in some Nilgiri sholas, very ferruginous when in young leaf.

		lbs.
W 3733.	Coonoor, Nilgiris, 6000 ft. (Gamble)	48
W 4038.	Lovedale, Ootacamund, 7000 ft. (Gamble)	48

B 3705 sent by H. C. Hill from Tenasserim under the name *Kyaisai* may be a *Phœbe*. The *wood* is light olive-brown, moderately hard. *Pores* moderate-sized, sometimes subdivided. *Medullary rays* fine, prominent. Weight 53 lbs. per cubic foot.

10. ALSEODAPHNE, Nees.

Three Indian species. *A. petiolaris*, Hook. f.; Fl. Br. Ind. v. 145, is a large tree of Assam, Cachar and Upper Burma, it may be the "*Dowki Poma*" described below. *A. grandis*, Nees; Fl. Br. Ind. v. 146; Kurz For. Fl. ii. 293, is an evergreen tree of Burma with a yellowish wood turning brown on exposure.

1. **A. semecarpifolia,** Nees; Fl. Br. Ind. v. 144; Bedd. Fl. Sylv. t. 297; Talbot Bomb. List 168; Trimen Fl. Ceyl. iii. 444. Vern. *Nelthare*, Kan.; *Phudgus*, Mar.; *Ranai, yavaranai*, Tam.; *Wewarani*, Cingh.

A large tree. *Bark* yellowish-brown, thick, vertically furrowed. *Wood* dark brown, moderately hard. *Pores* moderate-sized, scanty, enclosed in loose tissue. *Medullary rays* fine, wavy, not numerous.

Western Ghâts from Kanara to Cape Comorin up to 5000 ft.; dry region of Ceylon.

Beddome speaks of the wood as excellent, and Trimen says it is one of the best of Ceylon timbers.

The "Report on the Results of Mechanical Tests," by Professor W. C. Unwin, F.R.S., gives for *Ranai*—

Weight	. . . .	63 lbs. per cubic foot.
Shearing strength	. . . .	927 lbs. per square inch.
Crushing strength	. . . .	2·605 tons per square inch.
Coefficient of transverse strength	. . .	4·71 ,, ,,
Coefficient of elasticity	. . . . . .	459 ,, ,,

	lbs.
Ceylon specimen in Dehra Dún Coll. (Alexander)	47

2. A. sp., perhaps *A. petiolaris*, Hook. f.; Fl. Br. Ind. v. 145. Vern. *Dowki poma*, Assam.

Wood soft, red, even-grained. *Pores* small, in radial lines. *Medullary rays* fine, red, equidistant, visible on a radial section.

Assam.

The wood is used for boats, furniture and building.

	lbs.
E 633. Eastern Dúars, Assam (G. Mann)	32

TRIBE II. LITSEACEÆ.

11. ACTINODAPHNE, Nees.

A genus of about 21 evergreen shrubs or trees with usually more or less verticillate leaves. None of the species are found in North-West India, only three in Sikkim and Bhutan and three in Assam. Four are found in Burma. Six occur in Western and Southern India, and seven, all endemic, in Ceylon. *A. sikkimensis*, Meissn.; Fl. Br. Ind. v. 147; Gamble Darj. List 65; Vern. *Phirphiri*, Nep., is a tree of the Darjeeling Hills at 3–6000 ft., with a yellowish useful wood. *A. obovata*, Bl.; Fl. Br. Ind. v. 153; Gamble Darj. List 65; Vern. *Muslindi*, Nep.; *Pohor*, Lepcha, is a tree of the lower Darjeeling Hills up to 2000 ft., Assam, the Khasia Hills and Sylhet, with large obovate triple-nerved leaves often 18 in. long. *A. confertiflora*, Meissn.; Fl. Br. Ind. v. 154, is a Bhutanese tree found by Griffith near Dewangiri at 2–3000 ft. *A. reticulata*, Meissn.; Fl. Br. Ind. v. 147, is a tree of the Khasia Hills at 4–5000 ft. *A. angustifolia*, Nees; Fl. Br. Ind. v. 152; Brandis For. Fl. 381 (*Litsæa angustifolia*, Kurz For. Fl. ii. 305), is a tree of Assam, the Khasia Hills, Sylhet, Chittagong and Burma. *A. leiantha*, Hook. f.; Fl. Br. Ind. v. 154 (*Litsæa leiophylla*, Kurz For. Fl. ii. 305), is a tree of Tenasserim or the Andaman Islands. *A. concolor*, Nees; Fl. Br. Ind. v. 148 (*Litsæa concolor*, Kurz For. Fl. ii. 304), is a tree of Tenasserim, as is also *A. sesquipedalis*, Hook. f. and Th.; Fl. Br. Ind. v. 151 (*Litsæa macrophylle*, Kurz For. Fl. ii. 304). *A. salicina*, Meissn.; Fl. Br. Ind. v. 148, is a small tree of the Nilgiri Hills, found about Sispara. *A. campanulata*, Hook. f.; Fl. Br. Ind. v. 148 (*A. salicina*, Bedd. Fl. Sylv. t. 295), is a tree of the Western Gháts, especially Tinnevelly. *A. lanata*, Meissn.; Fl. Br. Ind. v. 149, is a tree of the Nilgiri sholas found near Coonoor, also in the S.-E. Wynaad. *A. madraspatana*, Bedd.; Fl. Br. Ind. v. 149 (*A. Hookeri*, Bedd. Fl. Sylv. t. 296), is a tree of the hills of Cuddapah and North Arcot, recognizable by its narrow leaves being very white beneath. *A. hirsuta*, Hook. f.; Fl. Br. Ind. v. 152, is a tree of the Travancore coast found at Quilon.

Of the Ceylon species, the most noticeable is *A. speciosa*, Nees; Fl. Br. Ind. v. 153; Bedd. Fl. Sylv. clxxxvii.; Trimen Fl. Ceyl. iii. 448, which has large rounded velvety wrinkled leaves, conspicuous in the hill forests at 5–8000 ft., and locally called "elephants' ears." It has a rather heavy, smooth, yellowish wood. *A. molochina*, Nees; Fl. Br. Ind. v. 150; Bedd. Fl. Sylv. clxxxvi.; Trimen Fl. Ceyl. iii. 445, is a common species in the hill sholas about Newera Ellia.

1. A. Hookeri, Meissn.; Fl. Br. Ind. v. 149; Talbot Bomb. List 168. Vern. *Pisha*, Mar.; *Jharchampa*, Uriya; *Tháli*, Tam.; *Iyóla*, *mala virinyi*, Mal.; *Neyáram*, *munáli*, *puvaccha*, Trav. Hills.

A moderate-sized tree. *Bark* light brown, smooth. *Wood* light brown, moderately hard, even-grained. *Pores* numerous, moderate-sized, evenly distributed or roughly arranged in oblique lines, often subdivided. *Medullary rays* uniform, moderately broad.

Western Coast forests in the Konkan and North Kanara, common at Mahabaleshwar; forests of Orissa on the East Coast, also probably the N. Circars.

C 3581. Burnai Forest, Khurdha, Orissa (Gamble).

12. LITSÆA, Lamk.

A large genus of about 56 species, in 5 subgenera.

Wood grey or brownish-grey or yellowish, soft to moderately hard. *Pores* small, uniformly distributed. *Medullary rays* fine, uniform.

SUBGENUS 1. TOMINGODAPHNE, Bl.

Four species, deciduous small trees of the Eastern Himalaya and adjoining mountain ranges. *L. Kingii*, Hook. f.; Fl. Br. Ind. v. 156; Gamble Darj. List 66, is a small aromatic deciduous tree of the upper forests of Darjeeling at 6–8000 ft., while *L. sericea*, Wall. and *L. oreophila*, Hook. f. come from the inner ranges of Sikkim, ascending to 11,000 ft.

1. **L. citrata**, Bl.; Fl. Br. Ind. v. 155; Gamble Darj. List 66. *Tetranthera polyantha*, Wall.; Kurz For. Fl. ii. 301. Vern. *Siltimber*, Nep.; *Terhilsok*, Lepcha.

A small deciduous tree, very aromatic. *Bark* thin, smooth, brown. *Wood* soft, grey. *Pores* moderate-sized, scanty. *Medullary rays* fine uniform, sharply defined. *Annual rings* marked by a dark line.

Eastern Himalaya from Sikkim to the Mishmi Hills, at 5–9000 ft.; Khasia Hills, at 5–6000 ft.; hills of Upper Burma.

A conspicuous small tree on patches of old cultivated land in the Darjeeling Hills. The fruit is eaten by Lepchas.

		lbs.
E 3410.	Senchul, Darjeeling, 8000 ft. (Gamble)	36

SUBGENUS 2. EULITSÆA, Benth.

Five species, trees with persistent leaves, leaves often greyish-tomentose. *L. tomentosa*, Herb. Heyne; Fl. Br. Ind. v. 157; Talbot Bomb. List 168; Trimen Fl. Ceyl. iii. 449; Vern. *Chikna*, Mar.; *Kosbada*, *landittan*, Cingh., is a moderate-sized tree with soft grey foliage found in the Western Ghâts from the Concan southwards, in the hills of the Ceded Districts and in Ceylon, up to 5000 ft. Trimen says the *bark* is thin, grey; and the *wood* yellowish, moderately hard and close-grained. *L. ligustrina*, Nees; Fl. Br. Ind. v. 158, is a small tree of the Nilgiri Hills and Carnatic. It has smallish leaves and flowers usually profusely. *L. undulata*, Hook. f.; Fl. Br. Ind. v. 158; Trimen Fl. Ceyl. iii. 450, is an endemic rather scarce tree of the low country of Ceylon.

2. **L. sebifera**, Pers.; Fl. Br. Ind. v. 157; Gamble Darj. List 66; Talbot Bomb. List 169. *L. chinensis*, Lamk.; Trimen Fl. Ceyl. iii. 449. *Tetranthera laurifolia*, Roxb. Fl. Ind. iii. 823; Brandis For. Fl. 319; Kurz For. Fl. ii. 297. *T. apetala*, Roxb. Fl. Ind. iii. 819. Vern. *Maida lakri, meda lakri, gwá, rián, chandra, gar bijaur, singrauf*, Pb., N.-W. Provinces; *Medh*, Oudh; *Churo, kathula*, Kumaon; *Katmara, shingran*, Garhwal; *Garoli*, Dotiál; *Kukúr chita*, Beng.; *Suppatnyok*, Lepcha; *Maida lakri*, Mar.; *Katakamma*, Reddi; *Narra alagi*, Tel.; *Óndón*, Burm.; *Elumpurukki*, Tam.; *Bomi, bombi*, Cingh.

A moderate-sized evergreen tree. *Bark* brown, 1 in. thick. *Wood* greyish brown or olive grey, moderately hard, shining, close and even-grained, seasons well, durable, is not attacked by insects. *Annual rings* indistinctly marked by a white line. *Pores* small and moderate-sized, usually subdivided radially, uniformly distributed. *Medullary rays* fine and moderately broad.

Throughout India from the Punjab along the Lower Himalaya and sub-Himalayan tract eastwards and southwards, reaching Burma and South and West India; Ceylon.

A fine tree of very variable appearance and nowhere very common; consequently the wood, though good, is not much in demand. Growth moderate, 6·7 rings per inch of radius. Weight 47 lbs. per cubic foot. The bark is used medicinally for external application bruised and mixed with goat's milk, for sprains and bruises.

		lbs.
O 253.	Garhwal (Brandis, 1868)	48
O 1373.	Gonda, Oudh (Dodsworth)	45
O 1484.	Kheri „	48
D 1087.	Madura, Madras (Beddome)	46
B 2286.	Andaman Islands (Col. Ford, 1866)	47

Nordlinger's Sections, vol. 9 (*Tetranthera laurifolia*).

SUBGENUS 3. CONODAPHNE, Blume.

Ten species, mostly Burmese. *L. lancifolia*, Roxb.; Fl. Br. Ind. v. 159 (*Tetranthera lancifolia*, Roxb.; Kurz For. Fl. ii. 300), is a small tree of the Eastern Himalaya from Bhutan eastwards, Khasia Hills, Sylhet and Burma; and *L. Wallichii*, Hook. f.; Fl. Br. Ind. v. 160 (*Lindera nervosa*, Kurz For. Fl. ii. 308), a handsome tree of the same region. *L. mishmiensis*, Hook. f. and *L. assamica*, Hook. f. are large trees of Assam. *L. grandis*, Wall.; Fl. Br. Ind. v. 162 (*Tetranthera grandis*, Meissn.; Kurz For. Fl. ii. 299), *L. amara*, Blume; Fl. Br. Ind. v. 163 (*Tetranthera amara*, Nees; Kurz For. Fl. ii. 299), and *L. rangoonensis*, Meissn.; Fl. Br. Ind. ii. 163, are trees of Burma. *L. venulosa*, Meissn.; Fl. Br. Ind. v. 161, is an evergreen straggling bush found in the hills of South India, especially Tinnevelly, at 3–4000 ft. *L. Kurzii*, King; Fl. Br. Ind. iii. 164, is a tree of the Andaman Islands.

3. L. polyantha, Juss.; Fl. Br. Ind. v. 162; Gamble Darj. List 66. *Tetranthera monopetala*, Roxb. Fl. Ind. iii. 821; Brandis For. Fl. 380, t. 45; Kurz For. Fl. ii. 299. Vern. *Meda, gwá, singraf, sangran, marda, kat marra, kakúri, kerauli, patoia, katmoria, papria, katmedh, kari, rand-kari*, Hind.; *Karkawa, karrka*, Dehra Dún; *Mendah, kari, kjera, toska, leja*, Gondi; *Leinja*, Kurku; *Ratmanti, kadmero*, Nep.; *Suphut*, Lepcha; *Bút, mogasong*, Mechi; *Sualu*, Ass.; *Huara*, Cachar; *Bolbek*, Gáro; *Mosonea*, Uriya; *Pojo, hajam*, Kól; *Pojoh*, Sonthal; *Baglall*, Mal Pahari; *Ranamba*, Mar.; *Ondôn*, Burm.

A moderate-sized evergreen tree. *Bark* dark grey, smooth, when old exfoliating in corky scales. *Wood* olive-grey, soft, not durable, is readily attacked by insects. *Annual rings* indistinct. *Pores* moderate-sized, uniformly distributed, often oval and subdivided. *Medullary rays* short, fine. The wood is very similar to that of *L. sebifera*, but is softer, not so durable, and the annual rings are not well marked.

Sub-Himalayan tract and Lower Himalaya from the Salt Range to Assam, ascending to 3000 ft.; Central India, Orissa and the Circars; Burma, in mixed and tropical forests.

A common tree in many parts of Northern India, very variable in foliage. Growth moderate to fast, 2 to 6 rings per inch of radius. Weight of wood 38 lbs. per cubic foot. The wood is used for agricultural implements. The leaves are used in Assam to feed the "muga" silkworm *Antheræa Assama*; they have a cinnamon-like smell when bruised.

		lbs.
O 246.	Garhwál (Brandis, 1868)	38
O 1367.	Gonda, Oudh (Dodsworth)	38

Nordlinger's Sections, vol. 9 (*Tetranthera monopetala*) (Tab. XII. 2).

SUBGENUS 4. CYLICODAPHNE, Nees.

Thirty-two species from various localities, especially Burma and Ceylon. *L. salicifolia*, Roxb.; Fl. Br. Ind. v. 167; Gamble Darj. List 66 (*Tetranthera lanceæfolia*, Roxb. Fl. Ind. iii. 822; Kurz For. Fl. ii. 300; *T. glauca*, Kurz For. Fl. ii. 300); Vern. *Paieli, sempat*, Nep., is a small tree of the sub-Himaláya from Oudh to Sikkim, ascending to 6000 ft., Assam, Chittagong and Burma. *L. oblonga*, Wall.: Fl. Br. Ind.

v. 168; Gamble Darj. List 66; Vern. *Tirhilsok*, Lepcha, is a small tree very common in the Sikkim Himalaya at 3–6000 ft. and extending to the Khasia Hills. *L. læta*, Wall.; Fl. Br. Ind. v. 169; Gamble Darj. List 66; Vern. *Akhaterwa*, Nep.; *Phamlet*, *chimplet*, Lepcha, is a small tree of the North-East Himalaya, Assam, the Khasia Hills and Sylhet, common in the lower Darjeeling Hills. *L. nitida*, Roxb.; Fl. Br. Ind. v. 174 (*Tetranthera nitida*, Roxb.; Kurz For. Fl. ii. 302), is a tree of the Eastern Himalaya, Assam and Burma. *L. Panamonja*, Ham.; Fl. Br. Ind. v. 175, is also a large tree of the East Himalaya, Assam and Burma, with flowers conspicuously in racemes. *L. khasyana*, Meissn.; Fl. Br. Ind. v. 164, is a tree of Sikkim at 6000 ft., Assam and the Khasia Hills. *L. semecarpifolia*, Wall.; Fl. Br. Ind. v. 165 (*Tetranthera semecarpifolia*, Wall.; Kurz For. Fl. ii. 303), is an evergreen tree of Eastern Bengal and Burma. *L. Meissneri*, Hook. f. is found in the Khasia Hills at 4–5000 ft., and *L. chartacea*, Wall. in Nepal and Sikkim at 5500 ft. Several species occur in Burma, but none of much importance.

L. coriacea, Heyne; Fl. Br. Ind. v. 166, *L. glabrata*, Wall.; Fl. Br. Ind. v. 174, *L. oleoides*, Meissn.; Fl. Br. Ind. v. 175, and *L. Beddomei*, Hook. f.; Fl. Br. Ind. v. 177, are all trees of the forests of South India in the Western Ghâts; while of those found in Ceylon, the most common and important are *L. glaberrima*, Thw., and *L. iteodaphne*, Thw.; Fl. Br. Ind. v. 173; Trimen Fl. Ceyl. iii. 452, both of the mountain regions.

4. **L. elongata,** Wall.; Fl. Br. Ind. v. 165; Gamble Darj. List 66. Vern. *Phusri*, Nep.; *Phane*, Lepcha.

An evergreen tree. *Bark* light brown, thin. *Wood* soft, greyish-yellow, with an unpleasant scent when freshly cut. *Pores* small, uniformly distributed. *Medullary rays* fine, numerous. *Annual rings* marked by a faint line.

Himalaya from Mussoorie eastwards, common in the Darjeeling Forests (var. *latifolia*) at 6–8000 ft.; Khasia Hills at 5–6000 ft.

E 3374. Darjeeling, 6000 ft. (Gamble).

5. **L. angustifolia,** Wall.; Fl. Br. Ind. v. 169. Vern. *Risapaing*, Beng.; *Shealbuk*, Magh.

A large shrub. *Bark* brown, thin. *Wood* soft, light brown or nearly white. *Pores* moderate-sized, uniformly distributed. *Medullary rays* short, fine to moderately broad.

River-banks in Chittagong, where it forms the most characteristic vegetation; Sylhet.

It has long, narrow, willow-like leaves. In Dr. Schlich's list of 1874 it is marked *Homonoya*, and indeed in leaves and in habit it resembles *H. riparia*.

E 3283. Rinkheong Valley, Chittagong Hill Tracts (Gamble).

6. **L. Stocksii,** Hook. f.; Fl. Br. Ind. v. 176; Talbot Bomb. List 169.

A large tree. *Bark* smooth, greyish-brown. *Wood* yellowish-grey, moderately hard. *Pores* small, single or in pairs or in threes, evenly distributed. *Medullary rays* fine, short, numerous, regular, the distance between them equal to the diameter of the pores.

Western Ghâts from the Konkan southwards, rising to 6000 ft.

W 4088. Naduvatam, Nilgiris, 5000 ft. (Gamble).

7. **L. Wightiana,** Wall.; Fl. Br. Ind. v. 177; Talbot Bomb. List 169. *Tetranthera Wightiana*, Bedd. Fl. Sylv. t. 293. Vern. *Keynjee*, Badaga; *Hammadi*, Kan.

A large evergreen tree. *Bark* light brown, smooth, with somewhat horizontal lenticels. *Wood* yellowish-brown, shining, hard. *Pores* small, often subdivided or in groups of 2 or 3. *Medullary rays* fine, white, numerous. *Annual rings* marked by a faint line.

Upper hills of the Western Ghâts, common near the falls of Gairsoppa and in the Nilgiri sholas, 6–8000 ft.

		lbs.
W 3859.	Aramby Forest, Ootacamund, Nilgiris, 7000 ft. (Gamble)	46

SUBGENUS 5. NEOLITSÆA, Benth.

Five species, characterized by triple-nerved leaves. *L. fuscata*, Thw.; Fl. Br. Ind. v. 178; Trimen Fl. Ceyl. iii. 453, is a small endemic tree of the higher hills of Ceylon at 6–8000 ft., frequent about Newera Ellia. *L. Mannii*, King; Fl. Br. Ind. v. 180, is a tree of the Khasia Hills.

8. L. lanuginosa, Nees; Fl. Br. Ind. v. 178; Brandis For. Fl. 382. Vern. *Kilban*, Pb.; *Kokra*, Hind.

A moderate-sized evergreen tree. *Bark* brown. *Wood* yellow when fresh cut, afterwards yellowish-brown. *Pores* small, arranged in radial groups and oblique lines. *Medullary rays* short, fine, numerous.

Outer Himalaya from the Indus eastwards to Sikkim at 3–6000 ft.; Khasia Hills.

A conspicuous tree easily recognized by its long leaves. In Jaunsar it frequents river-banks, and is common along the Tons and its tributaries.

H 2948. Sutlej Valley, Punjab, 3000 ft. (Gamble).

9. L. zeylanica, C. and Fr. Nees; Fl. Br. Ind. v. 178; Bedd. Fl. Sylv. t. 294; Talbot Bomb. List 169; Trimen Fl. Ceyl. iii. 454. *L. foliosa*, Nees; Kurz For. Fl. ii. 306. Vern. *Kanvel, chirchira*, Mar.; *Bodeda*, Saura; *Akupatrikam*, Tel.; *Belori*, Badaga: *Vayana*, Mal.; *Dawul-kurundu, kudu-dawula*, Cingh.

A small evergreen tree. *Bark* thick, smooth, grey. *Wood* light brown to yellow, moderately hard, even-grained. *Pores* small, often subdivided, evenly distributed. *Medullary rays* fine, numerous.

Bhutan, the Khasia Hills and Sylhet; Chittagong; Martaban Hills in Burma; Western Ghâts from the Konkan southwards, rising in the Nilgiri and other hill ranges to 7000 ft.; scarce in the Eastern Ghât Ranges, Rumpa Hills at 2000 ft.; moist region of Ceylon.

The wood is said to be used for house-building, and an oil is obtained from the fruit and used to burn.

W 4089. Lovedale, Nilgiris, 7000 ft. (Gamble).

No. 20, Ceylon Collection, new (Mendis).

10. L. umbrosa, Nees; Fl. Br. Ind. v. 179; Gamble Darj. List 66. *L. zeylanica*, Nees; Brandis For. Fl. 382. Vern. *Chirudi, shalanglu, rauli, chilotu, charkha, kaderu, narki, thirmal, zopru*, Pb.; *Kanwala, titbora, sara, shurar, jhatela, chirara, chirchira*, N.-W. P.; *Pooteli*, Nep.

A moderate-sized evergreen tree. *Bark* light grey, smooth. *Wood* grey, darker when old. *Annual rings* marked by a dark line. *Pores* small, uniformly distributed. *Medullary rays* fine, numerous.

Himalaya from Kashmir to Sikkim at 3–7000 ft.; Khasia Hills at 5–6000 ft.

A common tree in ravines and along streams in the West Himalaya, less common in Sikkim. (I am a little in doubt about specimen No. E 2420, which I cut myself, and which is now deposited at Dehra Dún. I write only from memory, but am inclined to think that it really is *Actinodaphne sikkimensis*, and not *Litsæa umbrosa*. The description above given is taken from No. H 3055, about which I have no doubts.) The fruit gives an oil which is used to burn, and in medicine.

		lbs.
H 63.	Nagkanda, Simla, 8000 ft.	36
H 3055.	Mahasu, Simla, 7000 ft. (Gamble)	38
E 2420.	Hoom Linding, Darjeeling, 5000 ft. (Gamble)	43

13. **DODECADENIA**, Nees. Three species, evergreen trees. *D. grandiflora*, Nees; Fl. Br. Ind. v. 181; Brandis For. Fl. 381; Kurz For. Fl. ii. 304, is a tree of

the Kumaon and Nepal Himalaya at 8000 ft. and the Kachin Hills in Burma. *D. Griffithii*, Hook. f. is found in Bhutan. *D. paniculata*, Hook. f.; Fl. Br. Ind. v. 181, is a tree of the Sikkim and Bhutan Himalaya at about 3000 ft.

14. LINDERA, Thunb.

Contains 14 species in four well-defined Subgenera, as well as 5 species of doubtful position.

In Subgenus 1, APERULA, as well as *L. assamica*, come *L. Meissneri*, King; Fl. Br. Ind. v. 182, of Assam and *L. latifolia*, Hook. f.; Fl. Br. Ind. v. 183 of the Khasia Hills at 5–6000 ft.

In Subgenus 2, POLYADENIA, come *L. reticulata*, Benth.; Fl. Br. Ind. v. 183, of Assam, *L. venosa*, Benth. of Bhutan and *L. bifaria*, Benth.; Fl. Br. Ind. v. 184 (*Daphnidium bifarium*, Nees; Brandis For. Fl. 383), of the Himalaya in Kumaon, and Nepal at 5000 ft., Assam and the Khasia Hills.

Subgenus 3, DAPHNIDIUM, contains, besides *L. pulcherrima*, *L. caudata*, Benth.; Fl. Br. Ind. v. 184 (*Daphnidium caudatum*, Nees; Kurz For. Fl. ii. 307), a small tree of the Khasia Hills and the hills of Burma, at 4–6000 ft., and *L. melastomacea*, Benth., a small tree of Assam and Sylhet.

Subgenus 4, SASSAFRIMORPHA, includes *L. heterophylla* and *L. Neesiana*, Benth.; Fl. Br. Ind. v. 186; Kurz For. Fl. ii. 309 (*Aperula Neesiana*, Blume; Brandis For. Fl. 383), a very aromatic small tree of the Nepal and Sikkim Himalaya at 6–8000 ft., giving one of the woods known as *Karaway*.

L. lancifolia, Thw.; Fl. Br. Ind. v. 187; Trimen Fl. Ceyl. iii. 454, is a tree of the Ceylon mountains, very scarce. *L. Laureola*, Coll. and Hemsl.; Journ. Linn. Soc. xxviii. 119, is a tree of the Shan Hills at 4000 ft.

1. L. assamica, Kurz For. Fl. ii. 308; Fl. Br. Ind. v. 182; Gamble Darj. List 66. Vern. *Paieli, pooalay, phusri*, Nep.; *Phamlet*, Lepcha.

A large evergreen tree. *Wood* yellow, turning olive-grey on exposure, moderately hard, even-grained. *Pores* small, occasionally in groups, uniformly distributed. *Annual rings* marked by firmer wood on the outside of each ring. *Medullary rays* fine, uniform and equidistant; the distance between them slightly greater than the transverse diameter of the pores.

Sikkim and Bhutan Himalaya at 6–8000 ft.; Khasia Hills; Nattoung Hills of Martaban.

Growth moderate to slow, 10 to 22 rings per inch of radius. A pretty wood, worthy of attention; it is used for building, chiefly as planking.

		lbs.
E 362.	Rangbúl, Darjeeling, 7000 ft. (Johnston)	34
E 2418.	„ „ „ (Gamble)	41

2. L. pulcherrima, Benth., Fl. Br. Ind. v. 185; Gamble Darj. List 66. *Daphnidium pulcherrimum*, Nees; Brandis For. Fl. 383; Kurz For. Fl. ii. 306. Vern. *Dadia*, Hind.; *Sisi*, Nep.; *Nupsor*, Lepcha; *Dingpingwai*, Khasia.

A large evergreen tree with thin bark. *Wood* reddish-white, moderately hard, even-grained. Structure similar to that of *L. assamica*.

Kumaon, Nepal and Sikkim Himalaya at 4–9000 ft., Khasia Hills, Burma.

Growth moderate, 4 to 12 rings per inch of radius. A round in the Bengal Forest Museum shows 5 rings per inch of radius. Wood used for building, cattle-yokes and occasionally tea-boxes. The leaves are aromatic. The tree coppices well.

		lbs.
E 368.	Rangbúl, Darjeeling, 7000 ft. (Johnston)	33
E 2417.	„ „ „ (Gamble)	40

3. L. heterophylla, Meissn.; Fl. Br. Ind. v. 186; Gamble Darj. List 66.

A small evergreen tree. *Bark* brown, rough, with corky lenticels.

Wood grey, moderately hard. *Annual rings* marked by firmer tissue on the outside of each ring. *Pores* small, uniformly distributed. *Medullary rays* fine, uniform.

Higher Darjeeling Hills, above 9000 ft.
Growth slow, 18 rings per inch of radius.

		lbs.
E 384.	Tonglo, Darjeeling, 10,000 ft. (Johnston)	42
E 3638.	Sandukpho „ 11,000 ft. (Gamble)	—

Tribe III. HERNANDIEÆ.

15. HERNANDIA, Linn.

1. **H. peltata**, Meissn.; Fl. Br. Ind. v. 188; Bedd. Fl. Sylv. t. 300; Kurz For. Fl. ii. 309; Trimen Fl. Ceyl. iii. 456. Vern. *Palatu*, Cingh.

A large tree. *Wood* grey, soft. *Pores* moderate-sized to large; collected in oblong or linear more or less concentric dark scattered patches of loose tissue. *Medullary rays* very fine, numerous, with occasional broader ones. Cellular tissue soft.

Sea-coasts of the Andaman Islands and Ceylon.

The leaves are peltate. The bark and young leaves are used in medicine as a purgative, the juice of the tree to remove hair (Bedd.).

		lbs.
E 4915.	Royal Botanic Garden, Calcutta (Prain)	20

Order XCIV. PROTEACEÆ.

A large Order of plants, chiefly Australian and South African, containing only one Indian genus, *Helicia*. Many of the species are cultivated on account of the beauty of their flowers or foliage; such are the species of *Hakea*, *Banksia* and *Grevillea*, the best known of which is *Grevillea robusta*, the "Silk Oak."

Beddome describes the excellent growth of introduced Proteaceæ on the Nilgiris, and mentions especially *Leucadendron argenteum*, R. Br. the "Silver tree" of the Cape, *Telopea speciosissima*, R. Br., the "Waratah" of New South Wales, and the Cape species of *Protea* as especially thriving. Interesting as the members of the Proteaceæ are for the beauty of their flowers, fruit and foliage, and for their variable forms, they produce but few plants of economic value. A few ornamental woods and a few edible nuts constitute the sum of their economic usefulness, but as plants of ornament, few natural orders can compare with them. The *Grevillea* has been so much cultivated in India, and so frequently reproduces itself naturally, that it may be almost ranked as a wild plant, and so I think it best to include it among the genera whose woods are described.

Wood moderately hard, red, reddish-white or reddish-brown. *Pores* scanty, in bars alternating with bars having no pores, the bars usually running together into concentric bands, which in some genera (*Hakea*, etc.) are regular, but in others (*Banksia*, etc.) are very irregular and curved. *Medullary rays* very broad and prominent, causing a silver-grain of broad plates, often of dark colour, and containing resin-cells, which are also sometimes seen among the pores. The structure is a characteristic one, and the members of the Order are generally easily recognized. See also *Arthrophyllum* in Araliaceæ, where, however, the scanty large pores are *not* always in the loose tissue.

1. HELICIA, Lour.

Eight Indian species. *H. robusta*, Wall.; Fl. Br. Ind. v. 191; Kurz For. Fl. ii. 311 (*Rhopala robusta*, Roxb. Fl. Ind. i. 363); Vern. *Joweea*, Sylhet; *Taukyat*, Burm.,

is a tree (Roxb. says "a large stout timber tree," the Fl. Br. Ind. "a small tree") of Assam, the Khasia Hills, and the hills of Martaban at 2–4000 ft. *H. excelsa*, Blume; Fl. Br. Ind. v. 191; Kurz For. Fl. ii. 312 (*H. salicifolia*, Presl; Kurz For. Fl. ii. 312; *Rhopala excelsa*, Roxb. Fl. Ind. i. 363), is a large tree of the forests of the Khasia Hills at 3–5000 ft., Sylhet, Chittagong and Tenasserim, running to a girth of 4 ft. *H. nilagirica*, Bedd.; Fl. Br. Ind. v. 190, is a tree of the western slopes of the Nilgiri Hills at 3–4000 ft. *H. travancorica*, Bedd.; Fl. Br. Ind. v. 191 (*H. robusta*, Bedd. Fl. Sylv. t. 301) is a tree of the hills of Travancore and Tinnevelly, in evergreen forests at about 4000 ft. *H. terminalis*, Kurz For. Fl. ii. 312; Fl. Br. Ind. v. 190, is a tree of the Kachin Hills of Burma; and *H. pyrrhobotrya*, Kurz For. Fl. ii. 312; Fl. Br. Ind. v. 192, a tree of the hills of Martaban at 4000 ft. *H. ceylanica*, Gardn.; Fl. Br. Ind. 190; Trimen Fl. Ceyl. 457, t. 79, is a small tree, endemic in the moist region of Ceylon at 2–4000 ft.

1. **H. erratica,** Hook. f.; Fl. Br. Ind. v. 189; Gamble Darj. List 66. *H. cochinchinensis*, Kurz For. Fl. ii. 311. Vern. *Taukyatkyi*, Ruby Mines, Burma.

A small evergreen tree. *Bark* grey, ¼ in. thick. *Wood* pinkish-grey, moderately hard, divided into narrow wedges by the medullary rays, the tissue between the rays dark-coloured and crossed at short intervals by ladder-like bars of loose texture and paler colour. *Pores* small, scanty, one or two only in each of the bars of pale soft tissue, none in the alternate darker bars. *Medullary rays* very broad, long, prominent on a radial section as a fine silver-grain. The bars are very close together and narrow, much more so than in *Grevillea*.

Sikkim Himalaya, at 2–6000 ft.; Khasia Hills, Shan Hills, hills of Martaban at 5–7000 ft.

Found in the Darjeeling Forests, chiefly in open ground or in coppice woods of chestnut and *Schima Wallichii*. The wood would do for inlay work and fancy articles, but is not durable.

		lbs.
E 2409.	Sumbong, Darjeeling, 2000 ft. (Gamble)	44

2. GREVILLEA, R. Br.

1. **G. robusta,** A. Cunn.; Benth. Fl. Aust. v. 459. Silk Oak.

A moderate-sized tree. *Bark* rough, ¼ in. thick. *Wood* hard, light reddish-brown; sapwood greyish-white. *Pores* moderate-sized, scanty, in curved bars which join into concentric bands of pale tissue. These concentric bands are interrupted by the medullary rays and bend outward where they meet the rays, so that they have a wavy outline, and are not always quite continuous. *Medullary rays* broad and very broad, very prominent on a radial section, showing a beautiful silver-grain. Occasionally a few fine rays are interspersed between the broad ones.

Indigenous in Queensland and N. S. Wales, cultivated in many places in India, especially in moderately cool climates like those of the Himalaya and the hills of South India. It thrives especially in the Nilgiris and in the Dehra Dún, but will also grow even in such places as Calcutta and Madras. It reproduces itself naturally from seed, as may be seen in the park at Dehra Dún. It is rather brittle, so that it should not be used to plant in windy places. In S. India, Ceylon and Java, it has been used as a shade plant in tea plantations. The wood is handsome, and if judiciously cut to show the silver-grain to the best advantage, would do well for panelling, parquet floors and furniture, but it requires careful seasoning.

		lbs.
E 3717, 3925.	Royal Bot. Garden, Calcutta (King)	36
O 3263, 4570.	Bot. Garden, Saharanpur (Gollan)	45
O 4638.	Forest School Garden, Dehra Dún (Gamble)	45

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ORDER XCV. THYMELÆACEÆ.

Shrubs or trees, usually with fibrous bark. There are eight Indian genera, belonging to three Tribes, viz.—

Tribe I. Euthymeleæ . . .	Daphne, Edgeworthia, Wikstrœmia, Lasiosiphon, Linostoma.
„ II. Phalerieæ . . .	Phaleria.
„ III. Aquilarieæ . . .	Gyrinops, Aquilaria.

1. DAPHNE, Linn.

Four species, three Himalayan and one Burmese, shrubs, or small trees (?). *D. involucrata*, Wall.; Fl. Br. Ind. v. 193; Gamble Darj. List 67; Vern. *Chota aryili*, Nep., is a large shrub of the Sikkim Himalaya up to 6000 ft., the Khasia Hills at 4–6000 ft., the Patkoye Hills of Assam and the mountains of Tenasserim. The bark is used in the manufacture of the tough Nepal paper, equally with that of *D. cannabina* and *Edgeworthia Gardneri*, the latter being, however, the principal species used. *D. pendula*, Sm.; Fl. Br. Ind. v. 194; Kurz For. Fl. ii. 333, is an evergreen shrub of the hills of Eastern Burma. *D. Mezereum*, Linn., the "Mezereon" and *D. Laureola*, Linn., the "Spurge Laurel" are well-known European shrubs.

Wood white, with a reticulated pattern, caused by oblique strings of loose tissue formed of comparatively large wood-cells, in which the *pores*, which are very small, occur. These patches alternate with large spaces of tissue without pores. *Medullary rays* fine or very fine, numerous. This structure is that of the two species examined, but is not constant for the genus; *e.g. D. Mezereum*, L. has no "tails" of loose pore-bearing tissue, while *D. Gnidium*, L. has them (see Nordlinger's Sections).

1. **D. oleoides**, Schreb.; Fl. Br. Ind. v. 193. *D. mucronata*, Royle; Brandis For. Fl. 384. Vern. *Laghúne*, Afgh.; *Pech*, Sind; *Kútilál, kanthan, gandalún, shalangri, zosho, shing, mashúr, juári, jiko, agru, swána, jikri, dona, channi niggi, kágsari, sind, kansian, sonái*, Pb.

A small branching shrub. *Bark* grey, with occasional prominent horizontal lenticels, *Wood* white, soft. *Annual rings* marked by a line of pores. *Pores* very small, collected in groups of light-coloured tissue, which are arranged in zigzag or oblique tails, forming a network with the regular and darker cellular tissue without pores. *Medullary rays* extremely fine, very numerous.

Baluchistan, Afghanistan, and the inner Western Himalaya as far east as Garhwal, 3–9000 ft.

Brandis says the wood is used in Chamba to make charcoal for gunpowder; the bark and leaves in native medicine and the berries for food; but these are said to cause nausea. He says that on the Sutlej a spirit is distilled from them. Aitchison (*Journ. Linn. Soc.* xviii. 91) says that it is common in the Hazarpírziárat, Kuram and Hariáb Districts up to 11,000 ft., in dry localities, with *Sophora mollis* and *Cotoneaster nummulariæfolia.* He says that camels will only eat it when very hungry, and that it is then poisonous.

P 4478. Baluchistan (Lace).

2. **D. cannabina**, Wall.; Fl. Br. Ind. v. 193; Gamble Darj. List 67. *D. papyracea*, Wall.; Brandis For. Fl. 386. Vern. *Niggi*, Pb.; *Dhak chamboi, charmua*, Jaunsar; *Satpura*, Garhwal; *Sat baruva, balwa*, Kumaon; *Gande, shedbarua, kaghuti*, Nep.; *Dayshing*, Bhutia.

A large evergreen shrub. *Bark* dark grey, smooth, with horizontal wrinkles and lenticels, inner bark fibrous. *Wood* white, moderately

hard. *Pores* extremely small, in long narrow oblique and bending tails of soft tissue. *Medullary rays* fine, numerous.

Himalaya from near the Indus to Bhutan, between 3000 and 9000 ft.; Khasia Hills.

Growth moderate, 9 rings per inch of radius. The flowers of the Sikkim plant are pink, very sweet scented; those of the West Himalayan plant white and often hardly scented at all. The bark is used to make Nepal and Bhutia paper, the commoner thin kind; also to make ropes for various purposes, such as carrying loads.

	lbs.
H 2826, 2828. Simla Forests, 700 ft. (Gamble)	—
H 4817. Kotikanásar, Jaunsar, 7000 ft. „	—
E 2408, 3661. Darjeeling, 7000 ft. „	34

2. EDGEWORTHIA, Meissn.

1. **E. Gardneri**, Meissn.; Fl. Br. Ind. v. 195; Brandis For. Fl. 386; Gamble Darj. List 67. Vern. *Kaghuti, aryili*, Nep.

A large shrub. *Bark* light brown, smooth, thin. *Wood* white, soft. *Pores* small, usually in radial pairs or threes. *Medullary rays* moderately broad, short, not numerous.

Central Himalaya, from Nepal to Bhutan at 4–7000 ft., scarce in Darjeeling.

The thick inner bark is used in the manufacture of the best quality of Nepal paper.

Sikkim, 5000 ft.—Kew Museum (J. D. Hooker).

3. WIKSTRŒMIA, Endl. Two species. *W. indica*, C. A. Mey.; Fl. Br. Ind. v. 195, is a shrub of Chittagong and Tenasserim, also found, but probably introduced as a weed, about Madras (*e.g.* Guindy). *W. canescens*, Meissn.; Fl. Br. Ind. v. 195; Trimen Fl. Ceyl. iii. 458 (Bedd. Fl. Sylv. clxxviii.; Brandis For. Fl. 386); Vern. *Chamboi*, Jaunsar; *Chamletu*, Garhwal; *Chamlia*, Kumaon; *Bhatniggi, thilak*, Pb., is a small yellow-flowered shrub of the Himalaya from the Sutlej to Nepal at 5–8000 ft., the Khasia Hills and Patkoye Hills of Assam at 5–6000 ft., the Shan Hills of Burma, and the upper hills of Ceylon. Aitchison also says it is common east of the Peiwar Kotal at about 8000 ft. The bark is fibrous and can be used for ropes and paper.

4. LASIOSIPHON, Fresen.

1. **L. eriocephalus**, Dcne.; Fl. Br. Ind. v. 197; Bedd. Fl. Sylv. clxxix.; Talbot Bomb. List 169; Trimen Fl. Ceyl. iii. 459. Vern. *Rami, ramita*, Mar.; *Nanju*, Kader; *Naha*, Cingh.

A small tree or large shrub. *Bark* grey, rather smooth, inner bark fibrous. *Wood* white or yellowish-white, hard. *Pores* small, single or in groups of 2 to 4, which are scantily distributed in short, more or less concentric patches. *Medullary rays* fine, irregularly spaced.

Hills of the Western Ghâts from the Konkan southwards, rising on the Nilgiris to 7000 ft. and to 4000 ft. in Ceylon.

A pretty plant with clusters of yellow flowers. The bark gives a fibre, and is used to poison fish (Bedd. and others). Growth slow.

	lbs.
W 3735. Coonoor, Nilgiris, 6000 ft. (Gamble)	55

5. LINOSTOMA, Wall. Three erect or climbing shrubs of Eastern Bengal and Burma. *L. pauciflorum*, Griff.; Fl. Br. Ind. v. 198; Kurz For. Fl. ii. 334, is an erect shrub of the drier hill forests, especially the pine forests, in the Martaban Hills at 3–4000 ft. *L. decandrum*, Wall. is an evergreen shrub of Sylhet, Chittagong and Tenasserim; while *L. scandens*, Kurz For. Fl. ii. 334 (*L. siamense*, Kurz For. Fl. ii. 335), is a climbing shrub of Burma, chiefly found in the Eng forests, and in the Shan Hills Terai.

6. PHALERIA, Jack. *P. cauliflora*, Benth.; Fl. Br. Ind. v. 199; Bedd. Fl. Sylv. clxxx.; Trimen Fl. Ceyl. iii. 459, is a rare small graceful endemic tree of the low country of Ceylon.

7. GYRINOPS, Gaertn.

1. G. Walla, Gaertn.; Fl. Br. Ind. v. 199; Bedd. Fl. Sylv. t. 303; Trimen Fl. Ceyl. iii. 460. Vern. *Wallá, pattawallá,* Cingh.

A small tree with slender trunk and small rounded head. *Wood* white, soft, of curious structure, somewhat like that of *Avicennia*. *Pores* small to large, scanty, arranged in narrow irregularly concentric lines of loose tissue. Between these lines come belts of ordinary cellular tissue in which the fine *medullary rays* are prominent.

Moist region of Ceylon up to 4000 ft.

The bark gives a very strong fibre of which ropes are made (Bedd. and Trimen). Mendis says the wood is used for buoys, targets, and rafters for cadjan roofs.

	lbs.
No. 149, Ceylon Collection, new (Mendis)	33

8. AQUILARIA, Lam.

Two species only of this genus are known from India, viz. *A. Agallocha*, here described, and *A. malaccensis*, Lamk.; Fl. Br. Ind. v. 200; Kurz ii. 336; from Tenasserim, which, according to Meissner, is the "Garo de Malacca," or Malacca Eaglewood. There is still some doubt about the identification of the species of *Aquilaria* which yields the Eaglewood of commerce. Roxburgh says the *A. Agallocha* is an immense tree, a native of the mountains east and south-east of Sylhet between 24° and 25° north latitude. "There can be little doubt that this is the tree which 'furnishes the real Calambac or Agallochum of the ancients, and there seems 'more reason to think that it was carried to China from our eastern frontier than 'to suppose it was carried from Cochin China or any other country in the vicinity 'of China, where it has always been in great demand. Small quantities are 'sometimes imported into Calcutta by sea from the eastward; but such is always 'deemed inferior to that of Sylhet." Kurz seems to consider the Sylhet and the Tenasserim tree as the same species, and as the structure of the wood of both is identical, there is a strong probability of his view being correct. Further investigation, however, is necessary to ascertain if the species described by Roxburgh as growing in Assam and Sylhet (*A. Agallocha*) is identical with the tree furnishing the *Akyau* wood of Burma.

In the *Jour. Agri-Hort. Soc. of India*, vol. xiii., Mr. C. Brownlow says that in Cachar there are two species, one of which is called *Petakhowra* and does not produce aloes wood, while the other has the aloes wood in the male trees only, called *Mooncas*, giving *Agur* or *Agallochum* or "Clign aloes." He says, "Occasionally but very rarely 'a tree is met with that contains as much as Rs.300 worth, sometimes the entire 'substance of the tree becomes converted into Agur for a considerable way up, so that 'a single blow of the axe lays it open. . . . It is possessed of great vitality and a 'wonderful power of renewing its bark, even when the latter has been scorched off by 'fire for 15 ft. or more above the ground: the wood is disposed in concentric layers 'which easily separate, and should the upper layer be splintered or detached, the parts 'impregnated with the peculiar resinous substance are protected from decay. . . . By 'the native method, the wood is bruised in a mortar and then subjected to distillation 'in water, the otto which comes over being more highly prized than that of roses." For other information see also "Watt. Dict. Econ. Products," vol. i. 278.

1. A. Agallocha, Roxb. Fl. Ind. 422; Fl. Br. Ind. v. 199; Brandis For. Fl. 387; Kurz For. Fl. ii. 335. Lign Aloes or Eaglewood. Vern. *Ugúr*, Hind., Beng.; *Sasi, hasi*, Ass.; *Akyau*, Burm.; *Kayu garu*, Malay.

A large evergreen tree. *Wood* white, soft, even-grained, scented when fresh cut. In the interior of old trees are sometimes found irregular masses of harder and darker-coloured wood, with a honey-like scent, which constitute the Eaglewood of commerce. *Pores* small and moderate-sized, in short radial lines. *Medullary rays* fine, numerous; the distance between two consecutive rays less than the

transverse diameter of the pores. Numerous short transverse bands of pores and intercellular ducts filled with a brownish substance.

Bhutan Himalaya, Assam, Khasia Hills, Eastern Bengal, Martaban Hills of Burma.

Growth moderate, 8 rings per inch of radius. Weight: Kyd gives 20 lbs.; specimens examined, 25 lbs. per cubic foot. Kyd gives P = 203. A description of Eaglewood and its method of collection is given in extracts from Mr. Lee's reports given at p. 80 of the Burma Forest Report for 1875-76, and at p. 19 of the Burma Forest Report for 1876-77. From these it appears that the Akyau is the most important forest produce of the forests of South Tenasserim and the Mergui Archipelago. It is found in fragments of various shapes and sizes in the centre of the tree, and usually, if not always, where some former injury has been received. To collect it, the trees are felled and allowed to rot for about three years in the forest, when they are again visited, the tree cut into fragments, and the odoriferous wood cut out. The uses of Eaglewood seem not to be very clearly known; apparently, however, the chief use is medicinal, but the wood is also used for ornaments. S. E. Peal, in *Ind. Tea Gaz.*, says he recommends the wood for tea-boxes in spite of its lightness, as it is durable and not liable to damage by white ants. He says, "The tree is often barked by natives for 'writing on, as the bark is thin, tough and very even in surface and texture." He further adds, "I have often also, when camping out, seen my men go and cut them-'selves large mattresses and even counterpanes of it and lay them on ferns." He explains that the tree does not suffer by being barked, which is rather strange! Kurz says the wood is used by the Karens for bows.

		lbs.
E 951.	Golaghát, Assam	24
B 1948.	Tavoy (Seaton)	23
B 2485.	„	29

ORDER XCVI. ELÆAGNACEÆ.

Contains two Indian genera only, Elæagnus, and Hippophaë, with six species. The leaves are covered beneath with silvery scales.

Pores small and moderate-sized. *Annual rings* distinctly marked by a belt of large pores. *Hippophaë* has numerous uniform and fine medullary rays, while *Elæagnus* has short rays of different width, which in some species are broad.

1. ELÆAGNUS, Linn.

Four species. *E. pyriformis*, Hook. f.; Fl. Br. Ind. v. 202, is a shrub of Upper Assam.

1. E. hortensis, M. Bieb.; Fl. Br. Ind. v. 201; Brandis For. Fl. 389. Vern. *Sanjit*, Afgh.; *Sirshing*, Tibet; *Shiúlik*, N.-W. Provinces.

A small deciduous tree or large shrub. *Bark* light grey, thick, fibrous, smooth, with deep longitudinal furrows. *Wood* soft to moderately hard: heartwood orange-brown; sapwood white. *Pores* moderate-sized, numerous in spring wood, where they mark the *annual rings*, less numerous outwards and arranged in roughly concentric lines. *Medullary rays* moderately broad, numerous.

Inner Western Himalaya, above 5000 ft.; extending westwards to Afghanistan and to Europe.

Brandis says it attains a height of "25 ft. with an erect, straight trunk, 5 to 6 ft. 'girth, and a rounded, close, handsome crown." The wood is used for fuel. It gives a transparent gum. The fruit is eaten, and in Yarkand a spirit is distilled from it. It is often planted. Mathieu Fl. For. 281 gives W = 36 to 41 lbs. per cubic foot.

Nordlinger's Sections, vol. 1.

2. E. umbellata, Thunb.; Fl. Br. Ind. v. 201; Brandis For. Fl. 390. Vern. *Ghiwáin, ghain, kankoli, bammewa*, Pb.; *Chindar*, Pangi; *Ginrci*, Jaunsar; *Ghiwanin*, Garhwal.

A thorny, deciduous shrub. *Bark* grey. *Wood* white, hard, even-grained, warps in seasoning. *Annual rings* distinctly marked by a narrow continuous belt of moderate-sized pores; in the rest of the wood the *pores* are very small and uniformly distributed, but occasionally intermediate bands or larger pores are found. *Medullary rays* short, broad.

Himalaya, from near the Indus to Bhutan, at 3-10,000 ft.

Growth moderate, 10 rings per inch of radius. The fruit is eaten. T. Thomson ("W. Himalaya and Tibet," p. 246) says that in the valleys of Iskardo the fuel consists almost entirely of this plant. Aitchison (*Journ. Linn. Soc.* xviii. 92) speaks of it as a tall tree cultivated for its flowers and fruit in the Kuram country.

		lbs.
H 71.	Mashobra, Simla, 7000 ft. (Gamble)	45

Nordlinger's Sections, vol. 1 (*E. parvifolia*).

3. **E. latifolia**, Linn.; Fl. Br. Ind. v. 202; Bedd. Fl. Sylv. clxxx.; Brandis For. Fl. 390, t. 46; Gamble Darj. List 67; Talbot Bomb. List 170; Trimen Fl. Ceyl. iii. 461. *E. conferta*, Roxb. Fl. Ind. i. 440; Kurz For. Fl. ii. 331. *E. arborea*, Roxb. Fl. Ind. i. 441; Kurz For. Fl. i. 331. Vern. *Ghiwáin, bana, midyali, mijhaula*, Kumaon; *Lohara, ghiwai*, Garhwal; *Jarila*, Nep.; *Guara*, Beng.; *Sheashong*, Gáro; *Kamboong*, Magh; *Kolungai*, Tam.; *Nurgi, ambgool*, Mar.; *Welembilla, katnembilla*, Cingh.; *Hmaingu, mingu*, Burm.

A straggling shrub, climber or small tree. *Bark* dark brown ¼ to ½ in. thick, deeply cleft in vertical or spiral fissures and peeling off in thick plates. *Wood* light yellow, moderately hard. *Pores* small to large, often oval, scanty. *Medullary rays* moderately broad, short, showing a good silver-grain.

Lower Himalaya and sub-Himalayan tract from the Sutlej to Bhutan, rising to 5000 ft., or perhaps more; Khasia Hills, Eastern Bengal and Chittagong; Burma, extending to the Shan Hills at 5000 ft.; hills of the Western Ghâts from the Konkan southwards, ascending to 7000 ft. in the Nilgiris; common at all elevations in Ceylon.

The fruit is eaten; it is pleasantly acid and refreshing. The wood is a good fuel.

		lbs.
O 4454.	Ré Nadi, Dehra Dún (Gamble)	41
E 2407.	Tukdah Forest, Darjeeling (Gamble)	45
W 3804.	Fairlawns, Ootacamund, Nilgiris, 6500 ft. (Gamble)	45

2. HIPPOPHAË, Linn.

Two species.

1. **H. rhamnoides**, Linn.; Fl. Br. Ind. v. 203; Brandis For. Fl. 388. Sea Buckthorn. *Argousier*, Fr. Vern. *Tsarap, tsarma, sirma, tsúk, tarru, niechak, tserkar, tsermang*, Ladak, Piti and Lahoul.

A large thorny shrub, sometimes a small tree. *Bark* grey, rough, with vertical furrows. *Heartwood* yellowish-brown, mottled, moderately hard, close-grained. *Annual rings* distinctly marked by the inner or spring wood being porous and mainly composed of numerous moderate-sized *pores*, the outer or autumn wood being more compact, with fewer and smaller pores. *Medullary rays* numerous, very fine, equidistant.

Inner tract of the West Himalaya, chiefly in moist, gravelly stream beds, from 5-15,000 ft.

Growth fast, 5 rings per inch of radius. Weight 44 lbs. per cubic foot: according to Mathieu Fl. For. p. 281, 38 lbs. to 54 lbs. The wood is used for fuel and charcoal, and the dry branches for hedges. It is very valuable in the dry, almost treeless tracts of the Inner Himalaya, and T. Thomson ("W. Himalaya and Tibet," p. 195, etc.) mentions the shrub being gregarious in dense, almost impervious thickets in Nubra and elsewhere in a country where it is the principal fuel. Aitchison says it is used

for hedges in the Hariáb District (*Journ. Linn. Soc.* xviii. 92). The fruit is eaten, but is very acid; it is made into a preserve.

		lbs.
H 135.	Lahoul, 10,000 ft. (Rev. W. Heyde)	44
H 3063.	Kunawar, 8000 ft.	—
	Nordlinger's Sections, vol. 1.	

2. **H. salicifolia,** Don; Fl. Br. Ind. v. 203; Brandis For. Fl. 387. Vern. *Ashúk*, Nep.; *Dúr chuk*, Kumaon; *Súrch*, *sutz*, Sutlej; *Taruwah*, Byáns; *Chúma*, N.-W. Provinces.

A large shrub or small tree. *Bark* dark grey, brown, soft, ½ in. thick, cleft in deep vertical furrows, and shallow cross ones into somewhat rectangular plates. *Wood* similar to that of *H. rhamnoides*, except that the *pores* in the autumn wood are fewer and smaller.

Himalaya, from Jamu to Sikkim, at 5–10,000 ft. or higher, usually in moister climates than *H. rhamnoides*.

This species is distinguished by the leaves being densely grey-hairy beneath as well as scaly. The fruit is also eaten, and the wood is used for fuel. Duthie says that, in Byáns, the deeply cleft bark favours the growth of epiphytes, so that it is usually covered with ferns ("Ind. Forester," xi. 4).

		lbs.
H 4642.	Datmir, Upper Tons Valley, Tehri-Garhwal, 8000 ft. (Gamble)	40

ORDER XCVII. LORANTHACEÆ.

Parasitic evergreen shrubs, five genera—Loranthus, Viscum, Arceuthobium, Notothixos and Ginalloa, some of the species very or even extremely small. They are of greater forest interest on account of the damage they may do, than on account of their size as woody plants.

1. LORANTHUS, Linn.

About 52 species, parasitic shrubs, some of which have large and conspicuous flowers. The genus, as described in Fl. Br. Ind. v., has eight subgenera.

Subg. 1. EULORANTHUS. 2 species. The chief species is *L. odoratus*, Wall. found in the Eastern Himalaya and the Khasia Hills, often on oaks.

Subg. 2. PHÆNICANTHEMUM. 11 species. *L. Wallichianus*, Schultz is a large species of the hills of S. India, often found in the Nilgiris on Australian Acacias as well as on the indigenous trees. *L. pentapetalus*, Roxb. is found in the Eastern Himalaya, Assam and Eastern Bengal; it is common in Darjeeling on oaks, maples, chestnuts and other trees. *L. ligustrinus*, Wall. is a Himalayan or sub-Himalayan species said by Brandis to be sometimes terrestrial or parasitic on roots. It grows chiefly on *Albizzia*, olive or laurels.

Subg. 3. HETERANTHUS. 1 species. *L. heteranthus*, Wall. is found in Martaban in Burma.

Subg. 4. CICHLANTHUS. 8 species. *L. Scurrula*, Linn. is a very common rusty-tomentose species found in many parts of India and Burma. *L. pulverulentus*, Wall. is a white-leaved species of Northern India, frequent in *Butea frondosa*. *L. vestitus*, Wall. chiefly occurs in the Himalaya, usually on oak.

Subg. 5. DENDROPHTHÆ. 17 species, the most important of which is *L. longiflorus*, Desr. *L. tomentosus*, Heyne is a very common Nilgiri species, growing on most shola trees, as do *L. neelgherrensis*, W. and A. and *L. memecylifolius*, W. and A., while *L. elasticus*, Desr. is a big shrubby species of the same region, but at lower levels.

Subg. 6. TOLYPANTHUS. 3 species, chief of which is *L. involucratus*, Roxb. of the Eastern sub-Himalaya and Assam.

Subg. 7. MACROSOLEN. 6 species. *L. ampullaceus*, Roxb. is found in Eastern Bengal and Burma, while *L. globosus*, Roxb. occurs in the Sikkim Lower Hills and the same region.

Subg. 8. ELYTRANTHE. 4 species, among which *L. loniceroides*, Linn. and *L. capitellatus*, W. and A. are noticeable common kinds in the hills of South India, the former very common on Australian Acacias.

All these species of *Loranthus* do considerable damage to forest trees. Perhaps the most noticeable case of injury is that done to the introduced Acacias planted as fuel trees

in the Nilgiri Hills. An account of their ravages is given in Dr. G. Bidie's "Report on Neilgherry Loranthaceous Parasitical Plants," Madras, 1874, and it is explained how the rough-barked *A. Melanoxylon* has suffered to a much greater extent than the smooth-barked *A. dealbata*. The only remedy known is the cutting and burning of the parasites whenever they can be got hold of. As pointed out by Mr. Clifford in "Ind. Forester," xxii. 1, most of the distribution of seed is done by birds, the chief distributers being probably species of *Dicæum*. The whole berry is not eaten, but the outer pulp, the bird wiping off the seed with its beak on to a branch, where it germinates.

Most species are called *Banda* or *Pand* in Hindi, *Ajeru* in Nepalese and *Kyibaung* in Burmese.

1. **L. vestitus**, Wall.; Fl. Br. Ind. v. 212; Brandis For. Fl. 396. Vern. *Pand*, Hind.; *Bánda*, Jaunsar.

A parasitic shrub. *Wood* reddish-white, compact, close-grained, moderately hard. *Pores* very small, arranged in rounded groups or patches, which are uniformly distributed. *Medullary rays* short, fine to broad; the distance between the rays several times larger than the transverse diameter of the pores.

West Himalaya from the Ravi to Nepal up to 7000 ft., Khasia Hills.

Growth slow, about 14 rings per inch of radius. Weight 51 lbs. per cubic foot. It grows often to a large size, and is extremely common in some parts of the Himalaya, especially on the Oaks, *Quercus incana* and *Q. dilatata*. It is also found on *Odina*, *Schleichera*, *Randia*, *Machilus* and other trees.

		lbs.
H 3033.	Theog, Simla, 7000 ft. (on *Q. dilatata*)	—
H 2938.	Below Naldehra, Simla, 5000 ft. (on *Q. incana*)	51

2. **L. longiflorus**, Desr.; Fl. Br. Ind. v. 214; Brandis For. Fl. 397; Kurz For. Fl. ii. 321; Gamble Darj. List 67; Talbot Bomb. List 171; Trimen Fl. Ceyl. iii. 468. *L. bicolor*, Roxb. Fl. Ind. i. 548. Vern. *Pand*, *amút*, Pb.; *Bánda*, C.P.; *Patha*, Banda; *Bara manda*, *faralla*, Beng.; *Proosti*, Lepcha; *Ajeru*, Nep.; *Banda*, *kainguli*, Mar.; *Yelinga wadinika*, Tel.; *Kaurak*, Bhil.

A parasitic shrub. *Wood* reddish, moderately hard. *Pores* very small, very numerous. *Medullary rays* short, fine to very broad.

Outer Himalaya from the Jhelum eastwards, ascending to 7500 ft.; Bengal; Central and South India; Burma, Andaman Islands and Ceylon.

The commonest species. It has large, handsome, scarlet flowers. It grows on most trees; in North India on *Melia*, *Bauhinia*, *Albizzia*, *Mallotus*, the Mango, Peach and Pear; also on Sundri and other trees in the Sundarbans; in Oudh on *Bassia*, *Buchanania*, *Diospyros*; in Sikkim on Sál and *Albizzia*; in the North-West Himalaya on Oak.

H 3061. Koti, Simla, 6000 ft. (on *Quercus dilatata*).

3. **L. neelgherrensis**, W. and A.; Fl. Br. Ind. v. 216; Trimen Fl. Ceyl. iii. 468.

A large parasitic shrub. *Bark* brown, rough. *Wood* reddish-brown, moderately hard. *Pores* moderate-sized, scanty, often subdivided. *Medullary rays* short, broad, evenly spaced.

Nilgiri Hills in S. India at 4–7000 ft.; Ceylon up to 7000 ft.: on various trees.

W 3901. Masnigudi, Nilgiris, 3000 ft. (Gamble).
W 4085. Lovedale, Ootacamund, 7000 ft. (Gamble).

2. VISCUM, Linn. About 11 species belonging to two sections: (1) those with leaves and (2) those without leaves, but with the internodes of the branches more or less flattened. In the first section the chief species is the "Mistletoe," *V. album*, Linn.; Fl. Br. Ind. v. 223; Brandis For. Fl. 392; Kurz For. Fl. ii. 323; Gamble Darj. List 68; Vern. *Túrapáni*, Afgh.; *Bhangra*, *bánda*, *bambal*, *kahbang*, *ahalu*, *wahal*, *rini*, *reori*, *reng*, *jerra*, Pb.; *Bán*, *bánda*, Hind.; *Hurchu*, Nep., a parasitic shrub found in the Suliman Range, Himalaya and hills of Martaban above 3500 ft., chiefly on the Walnut, Elm, Willow, Apricot and other Rosaceæ, Alder, Maple, Poplar, Olive and Mulberry.

In Lahoul it is used medicinally, and in Europe it is used for birdlime. The other species are *V. monoicum*, Roxb., found on trees in the Central and Eastern Himalaya and sub-Himalayan tract, the Khasia Hills, Burma and South India; *V. orientale*, Willd., found in Bengal, Burma, South India and Ceylon; *V. verruculosum*, Wt., *V. orbiculatum*, Wt., *V. capitellatum*, Sm. and *V. ramosissimum*, Wall., all South Indian species; and *V. ovalifolium*, Wall. of Burma and the Andaman Islands.

In the second section come *V. articulatum*, Burm. and *V. japonicum*, Thunb., found over the greater part of India, and *V. angulatum*, Heyne in Southern India and the Western Ghâts.

3. ARCEUTHOBIUM, Rich. *A. Oxycedri*, M. Bieb.; Brandis For. Fl. 394; Vern. *Shúk*, *sái*, Lahoul, is a small parasite found on *Juniperus excelsa* in Lahoul at 9–11,000 ft. It grows by spreading its roots between the bark and wood of the Juniper, often killing the branch on which it grows. It occurs also westward to the south of France. It is apparently not mentioned in Fl. Br. Ind. *A. minutissimum*, Hook. f.; Fl. Br. Ind. v. 227, is said by Hooker in Fl. Br. Ind. to be "the most minute dicotyledonous plant that I can call to mind." It is remarkable and important in a forest point of view on account of the serious damage it does to its host the Blue Pine (*Pinus excelsa*), on which it grows in masses in Kumaon and in Kashmir as discovered by Duthie, often completely damaging whole areas of forest, and rendering the trees incapable of producing proper timber. Duthie describes the plant as "at first sight appearing like bright green 'moss covering the smaller twigs of the pine tree" ("Ind. For." xi. 4).

4. NOTOTHIXOS, Oliv. *N. floccosus*, Oliv.; Fl. Br. Ind. v. 227; Trimen Fl. Ceyl. iii. 473, t. 80, is a small shrubby parasite on trees in the moist low country of Ceylon.

5. GINALLOA, Korth. Three species, parasitic shrubs resembling *Viscum*. *G. Helferi*, Kurz For. Fl. ii. 326; Fl. Br. Ind. v. 228, is found in Tenasserim; *G. spathulifolia*, Oliv.; Fl. Br. Ind. v. 228; Trimen Fl. Ceyl. iii. 473, in Ceylon; and *G. andamanica*, Kurz For. Fl. ii. 326; Fl. Br. Ind. v. 228, on *Artocarpus Chaplasha* trees in the Andaman Islands.

ORDER XCVIII. SANTALACEÆ.

Six species, trees or shrubs, some parasitic, belonging to two Tribes, viz.—

Tribe I. Osyrideæ	Pyrularia, Santalum, Osyris, Henslovia, Scleropyrum.
„ II. Anthoboleæ . . .	Champereia.

The only one of these of any importance is *Santalum*, the genus to which belongs *S. album*, the Sandalwood of India. In "A Note on Sandalwood" in "Ind. Forester," xx. 322, Dr. S. H. Koorders of Java says as follows:—

"Sandalwood is the product of various species of the genera *Santalum*, Linn. and '*Fusanus*, R. Br., which both belong to the family of the SANTALACEÆ. The most 'important of these two genera is *Santalum*, of which some 20 different kinds are 'known to be indigenous in Asia, Australia and Polynesia. Towards the east, *S. 'insulare*, Bert. is found in Tahiti and the Marquesas group, and is locally known as '*'Eai*.' The most southerly is *S. Cunninghamii*, Hook. f., found in New Zealand, 'and locally known as '*Mairi*.' In the Sandwich Islands, and generally in the north, '*S. pyrularium*, A. Gray and *S. Freycinetianum*, Gaud., are most common, both called 'by the Aborigines '*lanala*.' Towards the west, and especially in India, *S. album* is 'most frequently met with. Dr. Seemann discovered in the Fiji Islands a very 'valuable sandalwood tree, called by him *S. Yasi*, but this tree is already nearly 'extinct in consequence of unrestricted fellings. In New Caledonia, *S. Lomei* and *S. 'austro-caledonicum*, Vieill. are found, but these, from the same reason, are now 'scarce, although lately plantations have been formed in French territory. The wood 'of *S. latifolium*, *Fusanus spicatus*, R. Br. (*S. Cygnorum*, Miq.) and *F. acuminatus*, 'R. Br., is exported from S. W. Australia to England, as is also a so-called sandalwood 'from Queensland, the product of *Eremophila Mitchelli*, Benth. of the family MYO-'PORINEÆ. These woods possess only a weak scent and are chiefly used in carpentry 'and joinery. From Zanzibar small blocks of sandalwood are exported, and also from

'Venezuela sandalwood is sent to Germany, but the botanical origin of these woods is 'unknown; the former probably comes from the French station of Nossi-bé.

"Before the middle of the 18th century India was the only country which exported 'sandalwood, but since its discovery in the islands of the Pacific Ocean the largest 'quantities have been procured from thence, so that many of the local chieftains 'enriched themselves by this commerce; for instance, the chief of Hawaii in the 'Sandwich Islands is supposed to have derived an income of some £60,000 annually 'by the sale of sandalwood in the commencement of the present century. But the 'supply of sandalwood from the islands of the Pacific is now almost exhausted, and 'Australia hoped to occupy the market once entirely in the possession of Polynesia. 'In 1884, the export of the wood from Australia rose to 2620 tons, the product chiefly 'of *Fusanus acuminatus*, but the prices ruled low, on an average only £8 a ton, whereas 'the price of the best sandal in China rises from £12 to £40 per ton.

"In Europe and North America sandalwood is used for making objects of art and 'luxury, whilst sandal oil is employed in perfumery and for medicinal purposes. Its 'use in medicine has much increased during the last few years, and large quantities of 'wood are now required to furnish the oil which is employed successfully in those cases 'where the balsam of copaiba was formerly considered to be a specific. In the trade, 'three kinds are distinguished, East Indian, Macassar and West Indian. The first is 'a product of *S. album*, the second probably from a closely allied species, and the third 'from the pseudo-sandal of Venezuela, which has been before mentioned. This so-called 'sandalwood is exported chiefly from Puerto Caballo, where it is called '*bucita capitala*,' 'but the scent both of the wood and of the oil is very different from that of true 'sandal."

1. PYRULARIA, Mich.

1. **P. edulis**, A. DC; Fl. Br. Ind. v. 230; Gamble Darj. List 68. Vern. *Amphi, kurumas*, Nep.; *Safhyi*, Lepcha; *Pyabdechu*, Bhutia.

A small or moderate-sized thorny tree. *Bark* thin, grey. *Wood* white, moderately hard, close-grained. *Pores* small and very small, in oblique bands of softer tissue. *Medullary rays* fine and broad, numerous, prominently reticulated on a radial section.

Nepal, Sikkim and the Khasia Hills at 4–5000 ft.

Growth moderate, about 8 rings per inch of radius. The wood is used by Bhutias for butter-making implements, the sap as a rennet to curdle milk. The fruit is eaten by Lepchas in Sikkim.

		lbs.
E 2406.	Tukdah, Darjeeling, 5000 ft. (Gamble)	47
E 698.	Rangbúl, Darjeeling, 7000 ft. (Johnston)	50
E 3408.	Darjeeling, 6000 ft..	—

2. SANTALUM, Linn.

1. **S. album**, Linn.; Fl. Br. Ind. v. 231; Roxb. Fl. Ind. i. 442; Bedd. Fl. Sylv. t. 256; Brandis For. Fl. 398; Kurz For. Fl. ii. 329; Talbot Bomb. List 174. Sandalwood. Vern. *Chandan, chandal, sandal*, Hind.; *Gandha, gandada*, Kan.; *Srigandam*, Tam.; *Santagu*, Burm.

A small evergreen tree. *Bark* dark grey, nearly black, rough, with short vertical cracks, inner substance dark red. *Wood* hard, very close-grained and oily: sapwood white, scentless; heartwood yellowish-brown, strongly scented. *Annual rings* distinctly marked by more numerous and slightly larger pores in the spring wood. *Pores* small, numerous, evenly distributed. *Medullary rays* short, fine, numerous, uniform and equidistant.

Dry region of South India, in Mysore, Coorg, the S. Mahratta country, the Ceded Districts, the Carnatic, and the hills of the Western Ghâts, the Nilgiris and Coimbatore:

It is also perhaps occasionally found, wild or nearly so, in districts of dry climate to the north and south of the area described.

The Sandalwood tree affects chiefly open forest lands with grass and patches of trees, usually on a red, rather stony soil, and so far as is known, it is on such soils and in such conditions that the production of scented wood is the best. On this P. Lushington says, "The observations I have made in North Coimbatore as regards soil 'point to the fact that on rich soils the tree grows luxuriantly, but the actually scented 'wood is not in such large proportion as in trees that are slower grown. In my opinion, 'the best wood is obtained from rich soils mixed with rock, but that scented wood 'becomes less where the soil is rich and without stones. The best wood and the richest in 'oil is grown between 2000 and 3000 ft." ("Notes on the Sandal Tree in S. India," "Ind. Forester," vol. xxvi., Appendix). The sandal seed germinates in the shade, usually in clumps of a tree or two with bushes, and as the fruit is largely eaten by birds who void or drop the seeds from the branches of trees on which they perch, it is usually in such places that the seedlings appear. They also are frequently seen in hedges or among bushes near villages. As the plant grows, it requires more and more light, and if it obtains this either naturally by pushing itself through the upper vegetation, as it certainly can do, or more quickly with artificial aid, it ends by being itself the centre of a clump of shrubby vegetation, producing quantities of fruit to be eaten by birds and so disseminated. If carefully protected from fire and over-grazing, sandal will extend itself naturally without any artificial help on any really suitable land, so that careful protection and judicious management of existing forest areas, with occasional assistance in the way of the gradual removal of cover as the tree grows, give, I think, a better result than the expenditure of time and money on plantations. Much has been done in the way of the artificial planting of sandal, as has been described by such authorities as H. C. Hill, J. L. Pigot, P. Lushington, and previously by D. Hutchins and others, but the results have not been really satisfactory, for even the most successful pieces of plantation would seem to have cost too much. Consequently, planting work has been almost abandoned in favour of the dibbling of seed in the forest, and if this is systematically done in suitable places under the shade of other trees and clumps of bush, I believe it to be the best system of reproduction. All the same, all the evidence seems to show that with proper care plants in baskets or in bamboo or tile cylinders planted out among bushes have every chance of speedy success, but that planting in the open should never be attempted. Broadcast sowing is not likely ever to succeed. As P. Lushington says, "On the whole, I am inclined to think that the best way of 'aiding the reproduction of sandalwood artificially is to increase the scrub, and this is 'best effected by merely keeping out fire and grazing. As soon as the scrub reaches '2 or 3 ft., sandal reproduces naturally from seed dropped by birds, and this may 'perhaps be further assisted by dibbling." Foulkes recommends wounding the soil deeply and sowing the seed in lines alternating with some hardy species like *Xylia dolabriformis*, or else "dibbling the seed among stunted bushes." He says also "when young, grows as a root parasite," and this has been said, but less definitely, by others, though I am not aware that any one has yet proved it to be really the case.

The *rate of growth* of sandal varies considerably according to locality, *i.e.* soil, climate and conditions of growth. Beddome found 6, 4 and 3½ rings per inch of radius for planted trees in North Coimbatore, and in "Notes on Sandal," "Ind. Forester," iii., old trees in Mysore were found to give an average of 9·2 rings. Lushington mentions that for the purpose of Working Plans, 8 in. growth in girth per 10 years has been taken as an average rate, and the exploitable age fixed at 40 years, the minimum size of a native tree being taken at 32 in. at 4½ ft. above ground. The system of working in the Madras Presidency is that of selection fellings over one-tenth of the area yearly, so that each locality is gone over once in ten years, when all dead and dying trees are removed, as well as all roots and all trees above 32 in. girth. In Mysore, sandal, wherever found, is a "royal" tree, the property of the State, so that the greater part of the wood taken to market each year comes from trees in hedgerows and in scrub forests outside the reserved areas. The wood cut is taken to depôts called "Kothis," where it is prepared for sale by removing the sapwood which is not scented, and classifying the billets or pieces or shavings and even the dust, according to a rather elaborate classification. The following table, taken from J. L. Pigot's paper on sandalwood, written to accompany a fine trophy exhibited by the Maharaja of Mysore at the Paris Exhibition of 1900, gives the classification and the values of the different classes calculated from the results of the auction sales of seven years ending with 1898–99:—

Description of wood.	Rates per ton.	
	From	To
	Rs.	Rs.
First-class billets (or Vilayat Budh) . .	483	610
Second-class billets (or China Budh) . .	446	571
Third-class billets (or Panjam) . . .	442	565
Ghotla (or billets of short length) . . .	432	530
Ghat Badala	440	500
Bagaradad	354	511
Roots (first class)	500	580
„ (second class)	416	547
„ (third class)	381	555
Jajpokal (first class)	400	470
„ (second class)	375	440
Ain Bagar	350	432
Cheria (or large Chilta)	270	355
Ain Chilta	122	393
Hatri Chilta	175	401
Milva Chilta	40	•155
Basola Bukni	30	80
Sawdust or powder	400	500

The average annual sales in Mysore amount to 1841 tons; to which we may add 102 tons cut in Coorg, and about 75 tons in Madras, so that we may put down the Indian outturn at about 2000 tons. The Bombay sales amount to very little. The value of the yearly export from India is about £40,000.

Sandalwood is used in India in the manufacture of boxes, frames and other small articles, which are usually very beautifully carved. Some very fine specimens of this carving were exhibited at Paris in 1900. But the chief customer is China, and it is understood that most of the wood which goes there is made into coffins for rich people. A good deal also goes to Arabia, and some to Europe. The average weight of the wood is about 60 lbs. per cubic foot. Skinner gives P = 874, Fowke 878 lbs. The proportion of heartwood in an ordinary log of sandalwood has been estimated to amount usually to very nearly one-half.

A certain amount of the sandalwood produced is used for the distillation of a scented oil, which is used in perfumery and as a medicine of importance. The wood has been found suitable for engraving, but is probably too valuable for such a use as a regular matter. The tree may sometimes grow fairly big. Lowrie mentions one in Coorg which was 66 in. in girth at 5 ft. above ground.

In Mysore, sandal trees are sometimes attacked and even killed by the larvæ of the Cossid moth, *Zenzera coffeæ*, Nietner, which tunnels into the wood (Stebbing "Inj. Ins." p. 104). Sandal is also affected by a disease called "spike," the nature of which has not yet been ascertained (H. C. Hill, "Note on Sandal," 1901).

		lbs.
E 2489.	Botanic Garden, Calcutta (a tree blown down in the cyclone of 1864) (King)	56
D 1209, 2307, 3140.	Mysore	71, 60 and 60
D 3999.	Sandúr Forests, Bellary (Gamble)	63
D 4026.	Collegal, Coimbatore, Madras	63
D 1360.	Salem, Madras	61
No. 125, Ceylon Collection, new.	. . . .	—
	Nordlinger's Sections, vol. 11.	

I have recently received, by the kindness of F. B. Manson, Conservator of Forests, Tenasserim, specimens of *Nadapyoo* and *Nadanyi*, as well as of *Kalamet*, to supplement No. B 1950 (62 lbs.) received from Tavoy in 1878. Of these, Manson says, "The specimen of *Nadapyoo* was obtained in the bazar in Mergui, so that it may be 'imported sandalwood. That of *Nadanyi* was received with it, with the report that 'a tree is growing in Palaw township of Mergui." Both these are unmistakably sandalwood. The *Kalamet* specimens came, one from the Rangoon bazar, the other from the Mergui District, where the tree grows on the headwaters of the Theingôn

Choung, *i.e.* at the easternmost point of the District. "The wood is brought out by 'parties of men who organize an expedition for the purpose in the cold weather. Only 'dead wood is extracted, and it is pretended that if the tree is artificially killed the 'scent of the wood is impaired." The scent of *Kalamet* is quite different, to judge by Manson's specimens, from that of true sandalwood. It is rather difficult to describe, but most resembles that of the bog myrtle of Europe. The structure also differs, for the wood is darker in colour, the pores are larger, and somewhat concentrically arranged, the medullary rays are rather broader, more prominent and fewer, and the annual rings more marked (Nos. B 4920, 4921). I am in hopes of soon receiving good botanical specimens sufficient to clear up the question of the botanical position of the tree, which it is clearly important to do. See, also, Sir D. Brandis in Ind. For. xxvii. 516.

3. OSYRIS, Linn.

1. **O. arborea,** Wall.; Fl. Br. Ind. v. 232; Bedd. Fl. Sylv. clxxxi.; Brandis For. Fl. 399; Talbot Bomb. List 174; Trimen Fl. Ceyl. iii. 474. Vern. *Bakardharra, bakarja,* Kumaon; *Dalmi, dalima,* Garhwal; *Popoli, lotal,* Mar.; *Jhuri,* Nep.

An evergreen shrub or small tree. *Bark* dark greyish-brown, rough with shallow vertical fissures. *Wood* red, hard, close-grained. *Pores* small, regular. *Medullary rays* fine, regular, short.

Outer Himalaya and sub-Himalayan tract from the Sutlej to Bhutan, but not in Sikkim, ascending to 7000 ft.; Central Provinces and hills of the N. Circars; west coast from the Konkan southwards from sea-level to the top of the Ghâts, also in hill ranges of South India; Shan Hills of Burma; patana country of Ceylon at 3–5000 ft.

The shrub is usually very glabrous, ashy-coloured, but pubescent specimens (var. *puberula*) occur in the C.P. and Nilgiris. Aikin in Wallich's list rightly describes the wood as hard, compact and fine-grained.

		lbs.
H 4450.	Malkot Forests, Dehra Dún (Gamble)	62

4. HENSLOVIA, Blume. Three species, parasitic shrubs with the general appearance of the mistletoe. *H. granulata,* Hook. f. and Th. and *H. heterantha,* Hook. f. and Th.; Fl. Br. Ind. v. 232, 233; Kurz For. Fl. ii. 328; Gamble Darj. List 68; Vern. *Ajeru,* Nep., are found in the Eastern Himalaya at 2–7000 ft., on oaks, *Eugenia* and other trees, both species extending to Burma. *H. varians,* Bl. is a species from Tenasserim.

5. SCLEROPYRUM, Arnott. *S. Wallichianum,* Arn.; Fl. Br. Ind. v. 234; Talbot Bomb. List 174; Trimen Fl. Ceyl. iii. 475 (*Pyrularia Wallichiana,* Bedd. Fl. Sylv. t. 304); Vern. *Benduga,* Kan., is a small thorny tree of the Western Ghâts from the Konkan southwards; of the Shan Hills in Upper Burma; and of the moist hill region of Ceylon at 4–6000 ft. Beddome says it has a light-coloured, curiously-grained wood.

6. CHAMPEREIA, Griff. *C. Griffithiana,* Planch.; Fl. Br. Ind. v. 236; Kurz For. Fl. 330, is a small tree of Tenasserim and the Andaman Islands. Prain mentions having found it on the Great and Little Coco Islands and in the coast zone of Little Andaman as a common tree 30 to 50 feet high.

ORDER XCIX. EUPHORBIACEÆ.

A large but not very important Order of Forest plants, containing 57 Indian woody genera in six Tribes, viz.—

Tribe I. Euphorbieæ . .	Euphorbia.
„ II. Buxeæ . . .	Sarcococca, Buxus.
„ III. Phyllantheæ .	Bridelia, Cleistanthus, Actephila, Andrachne, Phyllanthus, Glochidion, Flueggia, Breynia, Sauropus, Putranjiva, Hemicyclia, Cyclostemon, Mischodon, Bischofia, Aporosa, Daphniphyllum, Antidesma, Baccaurea, Hymenocardia.
„ IV. Galearieæ . .	Galearia, Microdesmis, Platystigma.

Tribe V. Crotoneæ . .	Jatropha, Tritaxis, Aleurites, Croton, Givotia, Trigonostemon, Ostodes, Blachia, Dimorphocalyx, Agrostistachys, Sumbavia, Claoxylon, Acalypha, Adenochlæna, Cœlodepas, Alchornea, Podadenia, Trewia, Coccoceras, Cœlodiscus, Mallotus, Cleidion, Macaranga, Homonoia, Lasiococca, Ricinus, Gelonium, Chætocarpus, Baliospermum, Onesmone.
„ VI. Hippomaneæ .	Sapium, Excæcaria.

None of these genera produce trees of the 1st class as regards timber, the best being probably *Bischofia javanica*, and only a few like *Bridelia retusa*, *Phyllanthus Emblica*, *Cleistanthus collinus* and *Mallotus philippinensis* are sufficiently common to be of importance in Indian Sylviculture. The boxwood of the Himalaya is of considerable value, though the quantity is insufficient for a large trade; and a few other trees have woods of interest, such as *Daphniphyllum*, which has a wood streaked with bright red, and *Lasiococca* and *Hemicyclia*, whose wood is of much the same quality as box. A few other genera have trees which are of local importance, like *Hemicyclia* and *Excæcaria; and a few give products of value, but compared with Orders of a similar large* number of species, *Euphorbiaceæ* is certainly uninteresting in a Forest point of view. It contains nothing near the number of useful timbers that is produced in its great neighbour, the *Urticaceæ*.

The *Euphorbiaceæ* are generally characterized by the presence of poisonous principles, the poison being found in various parts of the plant, in the milky juice of *Euphorbia*, *Excæcaria* and *Sapium*; in the seeds and fruits in *Cleistanthus*, *Croton*, *Jatropha*, etc. It is also an important Order as one of those which give indiarubber; and notable among the plants which afford that most valuable product are the species of *Hevea*, giving the Pará rubber of commerce, and the *Manihot Glaziovii*, Muell. Arg., giving the Ceará. A species of *Hevea*, probably *H. braziliensis*, Muell. Arg., has been successfully cultivated in Tavoy, and it is now contemplated very largely to extend this cultivation as a Government undertaking. As is well known, the Pará Caoutchouc enjoys the highest estimation of all the varieties of the article in the trade, and the introduction of the cultivation of the best kinds of *Hevea* will be an important advantage to India. The Heveas are large trees with soft wood, and the collection of the milk is done by vertical incisions, allowing the juice to run into a vessel or bamboo. It is afterwards coagulated over a fire. The Ceará rubber tree has also been successfully cultivated in many places in India and in Ceylon. It is a small tree with the general appearance of a *Macaranga* or *Ricinus*, and does best in a somewhat dry climate. The seeds have a very hard shell, which usually requires to be filed to assist germination. The rubber is usually collected in Brazil by very lightly paring the outer bark, being careful not to cut through it, but only as far as the milk vessels. The milk which runs down is allowed to dry, when it is pulled off the tree and rolled into balls. The *wood* is soft and of a dingy white; it has small scanty *pores* arranged in roughly concentric lines and very fine numerous *medullary rays* (W 4121, Northernhay, Nilgiris, 3000 ft.—Gamble). Another species of the same genus, *Manihot utilissima*, Pohl., is the well-known plant much cultivated in Bengal, Burma and other parts of India, and giving the Cassava root and the tapioca of commerce. (*Wood* white, soft. *Pores* large, irregular, scanty, often subdivided. *Medullary rays* numerous, fine (Nordlinger's Sections, vol. 8)). Tan is yielded by the fruits of *Phyllanthus Emblica* and by the barks of some other species; castor-oil is given by *Ricinus communis* (see p. 622); a good oil by *Aleurites moluccana* (see p. 613), while the medicinal Croton oils are given by *Croton Tiglium* and *Jatropha Curcas*.

The *wood* of the trees of the Order EUPHORBIACEÆ has no very marked general distinguishing characteristic; but still it may be said that it is noticeable for the *pores* being usually more scanty than in many other Orders. In some genera they are characteristically arranged in short radial lines. In almost all genera the *medullary rays* are fine, close and uniform, in some they are very indistinct. In some genera, transverse ladder-like bars are conspicuous. In respect to colour, there are three classes, the white or grey, the red, and the

brown or greyish-brown. In respect to weight, some are very light, most are moderately so, few or none very heavy.

Among white-wooded genera, the most noticeable are—

(1) Soft woods: *Euphorbia, Jatropha, Givotia, Ostodes, Trewia, Sapium, Excœcaria.* Of these *Givotia* and *Trewia* show transverse bars; *Excœcaria* rather numerous and *Euphorbia, Sapium* and *Jatropha* very few pores.

(2) Moderately hard woods: *Sarcococca, Daphniphyllum, Cyclostemon, Croton.* Of these *Daphniphyllum* has numerous and *Croton* very few pores, while *Croton* and *Cyclostemon* show transverse bars.

(3) Hard woods: *Buxus, Hemicyclia, Lasiococca* and *Gelonium.* Of these *Buxus* has numerous, regular pores, the others somewhat scanty; while *Hemicyclia* has conspicuous, *Lasiococca* and *Gelonium* faint, transverse bars.

The red-wooded genera are fairly uniform in their structure, so that *Phyllanthus, Glochidion, Cleistanthus* are characterized by pores in short radial strings between regular numerous fine medullary rays. *Flueggia* has a harder close-grained wood, and *Bischofia* has rough open-grained wood with rather broad medullary rays.

In the genera with brown or greyish- or olive-brown wood, *Macaranga* is very soft, *Mallotus* pale-coloured and rather soft, *Bridelia* has a hard wood of characteristic appearance, and *Putranjiva* and *Baccaurea* present transverse bars, the latter wood being lighter and softer.

Tribe I. EUPHORBIEÆ.

1. EUPHORBIA, Linn.

A genus which chiefly contains herbaceous plants, but of which two subgenera include fleshy shrubs or trees of characteristic appearance. There are eight species, mostly plants of dry hot rocky slopes. I regret to be unable fully to check the wood descriptions and to make quite sure of their identification, having lost the corresponding herbarium sheets. I can only hope that my identification in the field was a correct one, as I believe it was. In Subgenus Tirucalli come *E. Tirucalli*, Linn. and *E. epiphylloides*, Kurz For. Fl. ii. 416; Fl. Br. Ind. v. 254, the latter an erect unarmed fleshy small tree of the rocky coast of South Andaman Island. In Subgenus Diacanthium come *E. neriifolia*, Linn., *E. tortilis*, Rottler, and *E. Royleana*, Boiss., as well as the following three others. *E. Nivulia*, Ham.; Fl. Br. Ind. v. 255; Bedd. Fl. Sylv. ccxvi.; Brandis For. Fl. 439; Kurz For. Fl. ii. 417; Talbot Bomb. List 176 (*E. nereifolia*, Roxb. Fl. Ind. ii. 467); Vern. *Thor, túr, senhur*, Hind.; *Suru*, Jaunsar; *Sij*, Beng.; *Newrang*, Mar.; *Jamadu*, Tel.; *Shazaung*, Burm., is a shrub with round branches, not ribbed, and pairs of spines in spirals which is found on dry rocky hills in the West Himalaya, Sind, Guzerat, Burma and South India, and is sometimes used for hedges. *E. antiquorum*, Linn.; Fl. Br. Ind. v. 255; Roxb. Fl. Ind. ii. 468; Bedd. Fl. Sylv. ccxvi.; Brandis For. Fl. 438; Kurz For. Fl. ii. 416; Gamble Darj. List 68; Talbot Bomb. List 176; Trimen Fl. Ceyl. iv. 4; Vern. *Nara sij, tekata sij*, Beng.; *Tidhára*, Hind.; *Shidu*, Mechi; *Narsej*, Mar.; *Kalli, chatura kalli*, Tam.; *Daluk*, Cingh.; *Shazaungpyathat*, Burm., is a small tree of dry places almost all over India, with 3–6 angled branches and pairs of stipular thorns. It is often used for hedges or planted in gardens, and by the Mechi tribe in the Terai, Dúars and Assam forests it is cultivated as a sacred tree. *E. trigona*, Haworth; Fl. Br. Ind. v. 256; Roxb. Fl. Ind. ii. 468; Bedd. Fl. Sylv. ccxvi.; Brandis For. Fl. 438 (*E. Cattimandoo*, Elliot; Brandis For. Fl. 438), is a small branching thorny tree with angular twisted stems, giving an abundant milk, which, like that of all the species, hardens into a kind of gutta-percha, and is used in medicine, as a cement and for other purposes.

E. pulcherrima, Willd.; Brandis For. Fl. 439; Kurz For. Fl. ii. 418 (*Poinsettia pulcherrima*, Grah.), is a well-known garden shrub with large crimson floral leaves, introduced from Mexico and cultivated in gardens in most parts of India.

Wood whitish, soft, cuts like cork. *Pith* large. *Pores* small, scanty, often subdivided. *Medullary rays* extremely fine and numerous.

1. **E. Tirucalli**, Linn.; Fl. Br. Ind. v. 254; Roxb. Fl. Ind. ii. 470; Bedd. Fl. Sylv. ccxvii.; Brandis For. Fl. 439; Kurz For. Fl. ii. 417; Talbot Bomb. List 176; Trimen Fl. Ceyl. iv. 5. Vern. *Lanka sij*, Beng.; *Sehud*, Hind.; *Nevli, thuvar, seyr*, Mar.; *Yele gulla*, Kan.; *Tiru kalli*, Mal.; *Kalli*, Tam.; *Nawahandi*, Cingh.; *Shazaunglethnyo*, Burm.

A large shrub or small tree. *Bark* brown or greenish-brown. *Wood* white or grey, moderately hard. *Pores* small, single or subdivided in 2 or 3, very scanty. *Medullary rays* extremely fine and numerous, regular.

Native of Africa, but naturalized in Bengal, the Peninsula and Ceylon, elsewhere cultivated.

This species is recognized by its round green unarmed branches. It is often used for hedges, especially in the Deccan.

		lbs.
C 3509.	Khurdha Forests, Orissa (Gamble)	—
D 4276.	Garladinné, Anantapur „	34

2. **E. nerlifolia**, Linn.; Fl. Br. Ind. v. 255; Bedd. Fl. Sylv. ccxvi.; Brandis For. Fl. 439; Kurz For. Fl. ii. 416; Talbot Bomb. List 176; Trimen Fl. Ceyl. iv. 5. *E. ligularia*, Roxb. Fl. Ind. ii. 465. Vern. *Mausa sij*, Beng.; *Gangichu*, Pb.; *Thor, nivarung, seej, mingut*, Mar.; *Kalli*, Tam.; *Yellikalli*, Kan.; *Patak*, Cingh.; *Shazaung*, Burm.

A small tree. *Bark* reticulated. *Pith* large, round. *Wood* white, soft, even-grained. *Pores* small, very scanty, usually in pairs. *Medullary rays* extremely fine and numerous.

Rocky places in the Deccan Peninsula and on the West Coast; elsewhere cultivated.

This species has more or less cylindric stem with 4 or 5 angled or ridged thorny ribs. It gives a copious milk used in medicine.

		lbs.
D 4174.	Dornál, Kurnool (Gamble)	26

3. **E. tortilis**, Rottler; Fl. Br. Ind. v. 256; Bedd. Sylv. ccxvi.; Brandis For. Fl. 439; Trimen Fl. Ceyl. iv. 5. Vern. *Sinuk*, Cingh.

A large fleshy shrub. *Bark* dark grey, rough, shining. *Pith* quadrangular. *Wood* soft, white or greyish-white, even-grained. *Pores* small, very scanty. *Medullary rays* extremely fine and numerous.

Dry districts of South India and Ceylon.

The stem and branches are roughly 4-angled and spirally twisted in broad wings set with spines.

D 4320. Ravúr Forest, Nellore (Gamble).

4. **E. Royleana**, Boiss.; Fl. Br. Ind. v. 257; Brandis For. Fl. 438. Vern. *Thor*, Pb.; *Sali*, Jhelum; *Chúla*, Chenab; *Chún*, Ravi; *Chú, chúnga, súrs*, Beas; *Sura, tsúi*, Sutlej; *Suru*, Jaunsar; *Sihúnd*, Kumaon.

A small tree with fleshy branches. *Wood* white, soft, spongy. *Pores* small, scanty, subdivided. *Medullary rays* extremely fine and numerous.

Outer Himalaya from the Jhelum to Kumaon, on dry rocky slopes, ascending to 6000 ft.; Salt Range of the Punjab.

This conspicuous species has 5-angled thorny stems, and is sometimes used for hedges.

P 3075. Sabathu, Punjab (Gamble).

TRIBE II. BUXEÆ.

2. SARCOCOCCA, Lindl.

1. **S. pruniformis**, Lindl.; Fl. Br. Ind. v. 266; Gamble Darj. List 68; Trimen Fl. Ceyl. iv. 9. *S. saligna*, Muell. Arg.; Bedd. Fl. Sylv. ccxvii.; Brandis For. Fl. 448. Vern. *Tiliári*, Jaunsar; *Piru*, Garhwal; *Sukatsing*, Kumaon; *Chilikat*, Nep.

A large or small evergreen, often straggling, shrub. *Bark* light brown, thin. *Wood* white, moderately hard, close- and even-grained. *Pores* very small, scanty, evenly distributed. *Medullary rays* fine to moderately broad, numerous, close.

Himalaya, almost throughout, at 5–9000 ft. or higher; Khasia Hills and Manipur at 4–6000 ft.; hills of the N. Circars above 4000 ft.; Western Gháts from Kanara eastwards, especially on Nilgiris at 6–8000 ft.; hills of Ceylon.

This shrub is very variable in size and appearance. In the West Himalaya it is quite small and hardly woody, with long narrow leaves, and is a very common undergrowth in the drier hill forests, especially those of oak and rhododendron; in the Darjeeling Forests, the leaves are broader but small and penniveined, and the shrub grows considerably larger, being not very common; on the Nilgiri Hills and in those of Ceylon it grows quite large and has broad rather large triple-nerved leaves, and it is there a straggling bush covering a considerable area in the underwood of sholas above 7000 ft. The wood is sometimes used for walking-sticks.

		lbs.
H 2832.	Simla Forests, 7000 ft. (Gamble)	—
C 3784.	Mahendragiri Hill, Ganjam, 4500 ft. (Gamble)	—
W 3809.	Ootacamund, Nilgiris (Gamble)	44

3. BUXUS, Linn.

1. **B. sempervirens**, Linn.; Fl. Br. Ind. v. 267; Brandis For. Fl. 447. The Box tree. *Buis*, Fr.; *Buxbaum*, Germ.; *Bosso*, Ital. Vern. *Shanda laghúne*, Afgh.; *Chikri*, Kashmir; *Papri, papar, paprang, shamshad, shumaj*, Pb.; *Shibsashin*, Byáns.

An evergreen shrub or small tree. *Bark* grey, soft, corky, cut into small plates by deep horizontal and vertical cracks. *Wood* yellowish-white, hard, smooth, very close- and even-grained. *Annual rings* distinctly marked by a narrow line without pores. *Pores* extremely small, numerous, uniform and uniformly distributed. *Medullary rays* fine to extremely fine, very numerous, short.

Suliman and Salt Ranges; Himalaya eastwards to Nepal and in Bhutan at 4–8000 ft., chiefly on calcareous soil. It does not occur regularly, but here and there in suitable places, chiefly in ravines and small valleys and usually on a northerly aspect.

The distribution of box in the Himalaya is not very easy to understand, as it does not seem to depend upon any very definite quality of climate, soil or surrounding vegetation. For the Punjab, Ribbentrop in "Ind. Forester," xi. 25 gives an account of boxwood localities, which shows that in the Rawalpindi Division there were about 500 acres, much of which was in the Margala Reserve on limestone at 2–3000 ft.; in the Shahpur Salt Range there were scattered patches on sandstone at 3500–4000 ft.; in Bashahr there were many localities, aggregating about 820 acres at 6–8000 ft., etc.; but that in all localities the box was constant in requiring a moist and sheltered place, preferring alluvial deposits along the banks of streams, disliking wind and choosing a north-west or northerly aspect.

In the North-Western Provinces, box is found in Jaunsar, in Tehri-Garhwal, in Garhwal and in Kumaon (see Hearle in "Ind. Forester," ix. 196, and Bryant in "Ind. Forester," xi. 283). The chief localities in Jaunsar are in the Matkangra and Jadi Blocks of the Deoban Forests, near Chakrata, both cool shady ravines on limestone at about 7000 ft. In Tehri-Garhwal there is a pretty forest at Datmir on the Upper Tons at about 8000 ft., and another in the Kangugadh at about the same elevation, and there are forests in the Jumna Valley. In British Garhwal and Kumaon, the forests, according to Bryant, are on slopes with a northerly or north-west aspect at 7–9000 ft.,

and rarely far from the Snowy Range. Duthie mentions fine specimens in the Kali Valley, Byáns, at 7–8000 ft. Bryant estimates 25,000 trees, an exploitable age of 80 years, the average tree giving about 3 cub. ft. My own opinion is that, if once started, box will grow in almost any Himalayan valley with a more or less northern aspect, and that the tree was probably in former times much more widely spread, the present localities being only the last resting-places.

Box trees grow to a large size in the Himalaya, occasionally attaining over 5 ft. in girth, while trees of over 3 ft. in girth are not at all uncommon, but the growth is usually very slow. Of the specimens herein mentioned, No. H 77 from the Shali gave 14, and H 38 from Kandru 16 rings per inch of radius, while H 990 from Kunawar gave as much as 75. The average was 33½. Brandis gives 15 to 20. If we assume 20 rings per inch as the rate and a radius of 6 in. as the size aimed at, we have the age of an exploitable tree as 120 years, and this is probably a minimum. The demand seems fairly good, for traders are constantly about in the hills ready to purchase trees of good size, so that it seems not only that it is right carefully to conserve existing areas, but that extension should be arranged for in suitable localities. At present, in Jaunsar, it is usual to sell only trees of above 3 ft. in girth, in selection, the number being fixed at what seems likely to maintain the supply, and this is the best system, and should be fixed in the Working Plans. Box reproduces well from seed, the seedlings bearing shade very well, but requiring to be helped to get more light by degrees. It also reproduces freely from cuttings, as may be seen on the Nilgiris where it is raised in quantities for the hedges in the Government Cinchona estates. It might be found worth while to plant it on shady northern aspects on the Nilgiris, as the nearness to the coast would make the sale of the wood much more profitable than it is from such distant places as the sites in the inner Himalaya.

The uses of boxwood are well known. In Europe it is used for engraving, turning, carving and mathematical instruments. In the Himalaya small boxes to contain butter, honey, tinder, snuff, etc., are made of it, and it is carved into combs. The boxwood to be used for engraving requires very careful and lengthened seasoning; on this subject and on the other requisite characters of boxwood for commercial purposes, the following extract from a letter of Messrs. J. Gardner and Sons, of Liverpool, to the Inspector-General of Forests, dated April 3, 1877, will give information:—

"The value of boxwood at Bombay of suitable texture for the English market, of 'which latter we can judge from a few sample pieces, will depend principally upon the 'quality.

"Wood from 2 to 4 in. diameter is required to be free from splits or cracks, other-'wise, however free from knots and straight and round it may be, the value would not 'exceed £1 to £2 per ton, whilst if free from splits, round and straight and with—

'Not exceeding one knot per foot in length	the value would probably be	£10 per ton
'Exceeding 1 knot and not exceeding 2 knots		£7 10s. "
" 2 knots " " 3 "		£5 "

'all knots or holes counted as such, however small.

"Wood 4 in. and upwards in diameter is preferred with one split rather than 'sound or with more than one split, any splits after the first reducing the value on 'account of the additional waste in working the same.

		Averaging per foot in length. 1 knot. £	2 knots. £ s.	3 knots. £ s.
"The value of round and straight (1 split) averaging	4 to 5 in. diameter	6	4 10	3 0
	5 to 6 " "	9	6 0	3 0
	6 in. and upwards diameter .	12	9 0	4 10

"If the splits are twisted more than 1 in. to the foot if small, 2 in. if medium 'size, and 3 in. to the foot length if large, the value is reduced one-half.

"The above values will, of course, vary in accordance with the supply and demand 'for the various sizes and qualities.

"The most suitable texture of wood will be found growing upon the sides of 'mountains. If grown in the plains, the growth is usually too quick, and consequently 'the grain is too coarse; 'the wood of best texture being of slow growth and very fine 'in the grain.

"It should be cut down in the winter, and, if possible, stored at once in airy

'wooden sheds, well protected from sun and rain, and not to have too much air 'through the sides of the shed, more especially for wood under 4 in. diameter.

"The boxwood also must not be piled upon the ground, but be well skidded under, 'so as to be kept quite free from the effects of any damp from the soil.

"After the trees are cut down, the longer they are left exposed the more danger is 'there afterwards of the wood splitting more than is absolutely necessary during the 'necessary seasoning before shipment to this country.

"If shipped green there is great danger of the wood sweating and becoming 'mildewed during transit, which causes the wood afterwards to dry light and of a 'defective colour, and in fact renders it of little value for commercial purposes.

"There is no occasion to strip the bark off, or to put cowdung or anything else upon 'the ends of the pieces to prevent their splitting.

"Boxwood is the nearest approach to ivory of any wood known, and will therefore 'probably gradually increase in value, as it, as well as ivory, becomes scarcer. It is 'now used very considerably in manufacturing concerns, but on account of its gradual 'advance in price during the past few years, cheaper woods are in some instances being 'substituted.

"Small wood under 4 in. is used principally by flax-spinners for rollers and by 'turners for various purposes, rollers for rink-skates, etc., etc., and if free from splits is 'of equal value with the larger wood. It is imported here as small as 1½ in. in 'diameter, but the most useful sizes are from 2½ to 3½ in., and would, therefore, we 'suppose, be from 15 to 30 or 40 years in growing, whilst larger wood would require '50 years and upwards at least—perhaps we ought to say 100 years and upwards. It 'is used principally for shuttles for weaving silk, linen and cotton, and also for rule-'making and wood engraving. *Punch*, *The Illustrated London News*, *The Graphic*, 'and all the first-class pictorial papers use large quantities of boxwood."

In the Himalaya, it has been found best, after felling the trees and sawing them into suitable billets, to cut one side of each billet from the circumference to the centre, so that it may, if liable to split, merely enlarge this crack and keep the rest of the wood free from clefts.

As regards sales, Gleadow ("Ind. Forester," vol. xxvi. Appendix i. 20) says, "Boxwood is so valuable that it has been exported from here to England; the first 'lot sent (1880), which weighed nearly 13 tons, realized £30 per ton. A second lot 'despatched in 1882, weighing 27 tons, realized £15 per ton, and a third lot, cut in 'the Kuphar forest on the Jumna in Tehri Garhwal, weighing 10 tons, was sent in '1884, and realized £20 per ton." Some sent from Naini Tál in 1880-81 realized £30 per ton. Marshall Ward, in Laslett's "Timber and Timber Trees," gives the market value at £28 per ton. The cost of extraction and freight come to about £10 per ton. But it is probable that, the available quantity being so limited, export sales are scarcely worth the trouble they cause, and that sales to the local dealers, who buy for local use, mostly at Amritsar in the Punjab, will suffice.

Weight: Brandis gives 60-65 lbs. per cubic foot; Mathieu, for European wood, 56-72 lbs., the specimens enumerated average 57 lbs.

The leaves are poisonous to cattle, only goats eat them sparingly with impunity; they are used in the south of France as manure for vineyards.

			lbs.
H	930.	Hazara, 7000 ft.	59
H	165.	Kangra (Stewart, 1866)	58
H	168.	Shahpur ,,	—
H	614.	Kulu, 7000 ft. (W. Pengelly)	56
H	954, 990.	Kunawar	54
H	38.	Kandru, Simla, 8000 ft.	60
H	77, 2914.	Shali, Simla, 7000 ft.	57
H	424.	Darna block, Deoban, Jaunsar, 7000 ft. (Bagshawe)	55

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Tribe III. PHYLLANTHEÆ.

4. BRIDELIA, Willd.

About 13 species, trees, shrubs or straggling climbers. *B. burmanica*, Hook. f.; Fl. Br. Ind. v. 269 (*B. amœna*, Kurz For Fl. ii. 368), is a small deciduous tree of

Upper Burma; *B. dasycalyx*, Kurz For. Fl. ii. 369; Fl. Br. Ind. v. 271, is a large climbing shrub of dry and open forests in Burma; and *B. minutiflora*, Hook. f.; Fl. Br. Ind. v. 273, is a tree of Tenasserim. *B. assamica*, Hook. f.; Fl. Br. Ind. v. 269, is a tree of Assam and Sylhet. *B. pubescens*, Kurz For. Fl. ii. 367; Fl. Br. Ind. v. 270, is an evergreen tree of the lower hills of Sikkim up to 5000 ft., and the eastern slopes of the Pegu Yoma. *B. Hamiltoniana*, Wall.; Fl. Br. Ind. v. 271; Bedd. Fl. Sylv. xcii.; Talbot Bomb. List 176, is a straggling shrub of the forests of Monghyr, the Kymore Hills and the Konkan Ghâts. *B. Griffithii*, Hook. f. (*B. ovata*, Kurz For. Fl. ii. 368) is a climbing shrub of the Andamans, and *B. Kurzii*, Hook. f. a climber of the Nicobar Islands.

Wood grey or olive-brown, seasons well. *Pores* small to moderate-sized. *Medullary rays* fine or moderately broad.

1. **B. retusa**, Spreng.; Fl. Br. Ind. v. 268; Bedd. Fl. Sylv. t. 260; Brandis For. Fl. 449; Kurz For. Fl. ii. 368; Gamble Darj. List 68; Talbot Bomb. List 176; Trimen Fl. Ceyl. iv. 10. *B. crenulata*, Roxb. and *B. spinosa*, Willd.; Roxb. Fl. Ind. iii. 734, 735. Vern. *Pathor*, *mark*, Pb.; *Khaja*, *kassi*, *gauli*, Hind.; *Gaya*, *dhaulo*, *gauli*, Garhwal; *Katganja*, *kulgaya*, Kumaon; *Ekdania*, Saharanpur; *Karjara*, Jeypore; *Lamkana*, Ajmere; *Angnera*, Banswara; *Asana*, *asauna*, *kanta kanchi*, Mar.; *Geio*, Nep.; *Pengji*, Lepcha; *Nanda*, Rajbanshi; *Katakuchi*, Mechi; *Kashi*, Gáro; *Kamkúi*, Chittagong; *Kosi*, Uriya; *Káj*, Monghyr; *Kadurpala*, Sonthal; *Kharaka*, *kaku*, Kól; *Karika*, Bhumij; *Kanj*, *kaji*, Kharwar; *Kosi*, *rugendi*, Khond; *Anepu*, Palkonda; *Anap*, Reddi; *Mulu-vengay*, *kamanji*, *mullu maruthu*, Tam.; *Koramau*, *dudi máddi*, *koramadi*, *duriamadi*, *kodari*, *bonta yepi*, Tel.; *Kassei*, Gondi; *Karka*, Kurku; *Gúnjan*, *kati ain*, Mar., Bhil; *Asuna*, *gojé*, *mulla honné*, *guorgi*, Kan.; *Mullangayum*, Mal.; *Adamarathu*, Tinnevelly; *Seikchi*, Burm.; *Keta kala*, Cingh.

A large deciduous tree, with thorns on the bark of young stems. *Bark* ½ in. thick, grey or brown, rough with longitudinal cracks and exfoliating in long irregular plates. *Wood* moderately hard to hard, grey to olive-brown, close-grained, seasons well. *Annual rings* marked by pale lines. *Pores* moderate-sized, in short radial groups, or single, scanty, the groups sometimes obliquely or almost concentrically arranged. *Medullary rays* numerous, uniform and equidistant, moderately broad, visible on a radial section as a silver-grain; the distance between two rays equal to, or less than, the transverse diameter of the pores.

Throughout India and Burma, except the very dry regions and the hills above 3500 ft., common in deciduous forests; low country of Ceylon.

Though never gregarious, this tree is abundant in many parts of the deciduous forests and the timber is everywhere more or less valued as one of the second-class woods; indeed, in Orissa and the Circars, it is in considerable demand and much liked. It has a fairly fast growth, about 5 to 6 rings per inch of radius.

Weight: Skinner, No. 291, gives 60 lbs.; R. Thompson, 54 lbs.; Brandis, No. 23, Burma List, 1862, 66 lbs.; the average of specimens examined is 52 lbs. Skinner gives P = 892. This is probably Kyd's *B. stipularis*, Vern. *Kohi*, Ass., Weight 64 lbs., P = 525. The wood is of good quality and colour, can be cut with a pretty grain and is durable; it is used for cattle-yokes, agricultural implements, carts and building. It stands well under water. The bark is used for tanning, the fruit eaten, and the leaves cut to feed cattle (Brandis).

			lbs.
P	461.	Ajmere	48
O	4821.	Thano, Dehra Dún (Gleadow)	55
O	259.	Garhwal (1868)	45
O	3001.	„ (1874)	43
O	1480.	Kheri, Oudh	61
O	347.	Gorakhpur (1868)	47
C	1174.	Ahiri Reserve, C.P. (R. Thompson)	55
C	840.	Bairagarh Reserve, Berar (Drysdale)	63
C	2765.	Melghát, Berar (Brandis)	45
E	645.	Darjeeling Terai (Manson)	53

			lbs.
E	619.	Bamunpokri, Darjeeling Terai (Bonham-Carter)	56
E	2428.	" " " (Gamble)	46
D	4013.	Cuddapah Forests (Higgens)	61
W	4146.	Wynaad, Malabar	45
B	3074.	Burma (Brandis, 1862)	46
B	1431.	Tharrawaddy Division, Burma	56

No. 70, Ceylon Collection, new (Mendis), is doubtful; it has the colour of *B retusa*, but not the weight nor quite the structure.

2. B. **Moonii**, Thw.; Fl. Br. Ind. v. 268; Bedd. Fl. Sylv. cci.; Trimen Fl. Ceyl iv. 11. Vern. *Pat kala*, Cingh.

A deciduous tree. *Wood* resembling that of *B. retusa*, except that the *pores* are rather smaller, more numerous, and the grouping less apparent.

Moist low country of Ceylon, up to 2000 ft.
No. 111, Ceylon Collection, new (Mendis).

3. B. **montana**, Willd.; Fl. Br. Ind. v. 269; Roxb. Fl. Ind. iii. 735; Bedd. Fl Sylv. ccii.; Brandis For. Fl. 450; Gamble Darj. List 68. Vern. *Kargualia, khaja yeia, kusi, gondni*, Hind.; *Geio*, Nep.; *Kaisho*, Ass.; *Patenga*, Tel.

A moderate-sized deciduous tree. *Wood* grey, moderately hard. *Annual rings* distinctly marked by darker and firmer wood on the outside of each ring. *Pores* small and moderate-sized, often in radial lines. *Medullary rays* fine, uniformly distributed, prominent in the silver-grain.

Sub-Himalayan tract from the Jhelum eastwards, ascending to 4000 ft.; Oudh, Bengal, Khasia Hills, Upper Burma.

Growth fast, 4 rings per inch of radius. The wood is very similar to that of *B. retusa* and might be used for the same purposes. The leaves are lopped for cattle-fodder, but are said not to be eaten by goats.

			lbs.
O	1375.	Gonda, Oudh (Dodsworth)	59
C	199.	Mandla, C.P. (1870)	46

4. B. **stipularis**, Bl.; Fl. Br. Ind. v. 270; Bedd. Fl. Sylv. cci.; Brandis For. Fl. 449; Kurz For. Fl. ii. 369; Gamble Darj. List 69; Talbot Bomb. List 176. *B. scandens*, Roxb. Fl. Ind. iii. 736; Trimen Fl. Ceyl. iv. 11. Vern. *Madlatah, undergúpa*, Oudh; *Lilima, loima lara*, Nep.; *Kihur, kohi*, Ass.; *Harinhara*, Beng.; *Gour kassi*, Uriya; *Sinmanopyin*, Burm.

A large straggling or climbing shrub. *Bark* brown. *Wood* greyish-brown, moderately hard, with numerous very fine, concentric, transverse bars. *Pores* scanty, often subdivided or in short radial lines. *Medullary rays* fine, numerous, uniformly distributed, the distance between them less than the transverse diameter of the pores.

Sub-Himalayan tract from the Ganges to Bhutan; Oudh, Bengal, Assam and southwards through both Peninsulas; Ceylon.

A very common plant in some parts of India as in Oudh, Northern Bengal, Chota Nagpore, Orissa and the Circars, but I never saw it west of the Ganges. The wood is said to be used for fuel in the Sundarbans.

C 3503. Khurdha Forests, Orissa (Gamble).

5. B. **tomentosa**, Bl.; Fl. Br. Ind. v. 271; Kurz For. Fl. ii. 367; Gamble Darj. List 69. *B. lanceæfolia*, Roxb. Fl. Ind. iii. 737. Vern. *Sibri*, Nep.; *Mantet*, Lepcha; *Sirai, mindri*, Beng.

A small evergreen tree. *Wood* light olive-brown, hard, close-grained. *Pores* small, often subdivided, enclosed in rounded patches

of soft tissue, which are generally arranged in oblique, undulating lines. *Medullary rays* very fine, very numerous.

East Himalaya, ascending to 2000 ft.; Eastern Bengal and Burma; Andamans and Nicobars.

		lbs.
E 1397.	Chittagong (Chester)	64
C 3498.	Dhalbhúm, Chota Nagpore (Gamble).	

I am not quite sure that this latter specimen does not belong to *B. Hamiltoniana*, but I have unfortunately lost the corresponding Herbarium specimens.

Nordlinger's Sections, vol. 9.

5. CLEISTANTHUS, Hook. f.

Twelve species, four of which are small Ceylon trees of no importance. *C. chartaceus*, Muell. Arg.; Fl. Br. Ind. v. 275 (*C. oblongifolius*, Brandis For. Fl. 451. *Cluytia oblongifolia*, Roxb. Fl. Ind. iii. 730); Vern. *Dukesa*, Sylhet, is a small spreading tree of Sylhet. *C. malabaricus*, Muell. Arg.; Fl. Br. Ind. v. 276; Bedd. Fl. Sylv. cciii.; Talbot Bomb. List 177, is a tree of the evergreen forests of the Konkan and North Kanara, usually near rivers, common round the Falls of Gairsoppah (Talbot). *C. stenophyllus*, Kurz For. Fl. ii. 370; *C. lancifolius*, Hook. f. and *C. Helferi*, Hook. f. are small trees of Tenasserim.

Wood hard, reddish-brown, close-grained. *Pores* in short distant radial strings between the fine regular numerous *medullary rays*.

1. **C. collinus**, Benth.; Fl. Br. Ind. v. 274; Trimen Fl. Ceyl. iv. 12. *Lebedieropsis orbicularis*, Muell. Arg.; Bedd. Fl. Sylv. cciii.; Brandis For. Fl. 450. *Cluytia collina*, Roxb. Fl. Ind. iii. 732. Vern. *Garrar*, *gharrar*, C.P.; *Karada*, *korada*, *korera*, Uriya; *Karada*, Khond; *Ghara*, Melghát; *Odeshi*, Palkonda; *Korishi*, Koya; *Odisha*, Reddi; *Parasu*, *pás*, Kól; *Kergaili*, Kharwar; *Garári*, Mar.; *Korei*, *wodesha*, *kadishen*, *korshe*, *kodarsi*, Tel.; *Wodayu*, *waddan*, Tam.; *Madaru*, Cingh.

A small deciduous tree. *Bark* $\frac{1}{4}$ in. thick, dark brown, almost black, often with a reddish tinge, rough with numerous cracks, exfoliating in rectangular woody scales. *Wood* dark reddish-brown, tough, hard, close-grained; heartwood small. *Pores* small, arranged radially in short groups at intervals between the very fine and numerous equidistant *medullary rays*.

Bandelkhand, C.P., Chota Nagpore, the Circars and southwards, in dry forests; rare in Ceylon.

A useful tree with a hard wood, valued for house-posts in the Circars, Hyderabad and the Deccan generally. Mr. Biscoe (Conservator of Forests, Hyderabad) says, "it 'is one of the most generally used and important trees in the Nizam's dominions. It 'is greatly valued in its pole stage. The favourite poles are those from 18 to 22 in. in 'girth. They are dressed and split from end to end in the forests, and sold in the 'neighbouring towns and villages for 6 to 8 annas each. They are very durable and 'quite as popular as teak" ("Ind. Forester," xxii. 220). It is very common in its region, and is easily reproduced in coppice, so that, as it is as good a fuel as it is a house-post wood, and as it is not browzed by cattle, it is distinctly a tree to be encouraged in those forests which are worked for village supply. The hard wood is also rather handsome and can be used for turning.

The outer crust of the capsule is said by Ainslie and Roxburgh to be exceedingly poisonous, as are also the leaves and roots. The bark has been examined and reported on by D. Hooper ("Ind. Forester," xxiv. 161), who found no special alkaloids, but thought that it was the tannin it contained which caused it to be poisonous to fish. The wood weighs about 54 lbs. per cubic foot. The mean growth may be taken at 6 rings per inch of radius.

		lbs.
C 1175.	Ahiri Reserve, C.P. (R. Thompson)	54
C 3452.	Betlah Reserve, Palamow (Gamble)	—
C 1252, 1306.	Gumsúr, Madras (Dampier)	55 and 54
C 4853.	Gullery Reserve, Ganjam (Gamble)	52

Nordlinger's Sections, vol. 9 (*Lebedieropsis orbicularis*) (Tab. XII. 4).

This wood resembles that of *Eugenia operculata* in outward appearance and in structure, but differs by the absence of concentric lines. It is almost identical with that of *Flacourtia Ramontchi*, and if it were not for the great difference in the bark, which in *Cleistanthus collinus* is dark-coloured, almost black and deeply fissured, and in *Flacourtia* light-coloured, smooth, with short narrow horizontal cracks, one might be inclined to suspect a mistake in the specimens. The only difference that can be seen under the lens is that the medullary rays in *Flacourtia* are slightly wavy, while those of *Cleistanthus* are straight; but this character is not of much value.

2. **C. myrianthus,** Kurz For. Fl. ii. 370; Fl. Br. Ind. v. 275. Vern. *Momantha*, Burm.

A moderate-sized evergreen tree. *Wood* moderately hard, reddish-grey. *Pores* small, numerous, often subdivided. *Medullary rays* fine, very numerous, closely packed.

Tropical forests of Burma and the Andaman Islands.

	lbs.
B 2474. Andamans (Kurz, 1866)	41

3. **C. patulus,** Muell. Arg.; Fl. Br. Ind. v. 279; Bedd. Fl. Sylv. ccii.; Trimen Fl. Ceyl. iv. 13. *Cluytia patula*, Roxb. Fl. Ind. iii. 783.

A small tree. *Bark* thin, light brown, papery. *Wood* reddish-brown, hard, close-grained. *Pores* small, in radial strings of 3 to 6 between the fine, numerous and equidistant *medullary rays*.

Circars, Deccan and Carnatic, chiefly in ravines or in dry evergreen forests; low country of Ceylon.

	lbs.
C 3950, 3956. Rekapalle Hills, Upper Godavari (Gamble) . .	51 and 53

6. ACTEPHILA, Blume. Two species. *A. excelsa*, Muell. Arg.; Fl. Br. Ind. v. 282; Bedd. Fl. Sylv. clxxxix. (including *A. Thomsoni*, Muell. Arg.); Talbot Bomb. List 177 (*A. javanica*, Miq.; Kurz For. Fl. 340, *A. neelgherrensis*, Wight; Trimen Fl. Ceyl. iv. 14), is a small tree of Upper Assam, the Khasia Hills, Sylhet, the Andaman Islands, the Western Ghâts up to 6000 ft. and Ceylon, not uncommon in the Nilgiri sholas. *A. puberula*, Kurz For. Fl. ii. 341; Fl. Br. Ind. v. 283, is an evergreen shrub of the Andaman Islands.

7. ANDRACHNE, Linn.

1. **A. cordifolia,** Muell. Arg.; Fl. Br. Ind. v. 283; Brandis For. Fl. 456. Vern. *Kúrkni, gúrgúli*, Jhelum; *Bersu*, Chenab; *Barotri, madáre*, Ravi; *Mútkar, chírmútti, pín*, Beas; *Tsátin*, Sutlej; *Bhartoi*, Jaunsar.

A small shrub. *Wood* white, moderately hard, close-grained. *Pores* very small and extremely small, larger and more numerous in the inner belt of the *annual rings*. *Medullary rays* extremely fine, very numerous.

West Himalaya, from the Indus to Nepal, ascending to 8000 ft.

	lbs.
H 2945. Jander, Sutlej Valley, 3500 ft. (Gamble)	45

8. PHYLLANTHUS, Linn.

A large genus containing plants of all sizes, many of which, more or less shrubby but of very little interest, have been omitted here. I have only mentioned those of some importance, from their size, frequency or economic value. They belong to seven subgenera.

Subgenus 1. KIRGANELIA.

1. **P. reticulatus,** Poir; Fl. Br. Ind. v. 288; Bedd. Fl. Sylv. cxc.; Brandis For. Fl. 453; Gamble Darj. List 69; Talbot Bomb. List 177; Trimen Fl. Ceyl. iv. 19. *P. multiflorus*, Roxb. Fl. Ind. iii. 664, *Cicca reticulata* and *C. microcarpa*, Kurz For

Fl. ii. 354–5. Vern. *Panjúli*, Hind.; *Makhi*, Bhurtpur; *Pavan*, Mar.; *Datwan*, Guz.; *Sitki*, Beng.; *Kabonan*, Merwara; *Nella púrúdúdú*, *phulsar*, Tel.; *Pula*, *pullanti*, *mipullanti*, Tam.; *Wel-kayila*, Cingh.

A straggling shrub. *Bark* brown, thin. *Wood* reddish- or greyish-white, hard, close-grained. *Pores* small or moderate-sized, scanty. *Medullary rays* fine to broad, numerous, wavy.

Throughout the greater part of India, Burma and Ceylon, in the dryer regions, in ravines and along streams, in hedges and on waste places near villages.

The wood is rather variable: Stocks' Sind specimen in Kew Museum has the structure of a climber with soft porous wood. Manson says the charcoal is a favourite one for making the balls which are sold for lighting hookas, and that the ashes of the wood are mixed with *gáb* fruit (*Diospyros Embryopteris*) glue for paying boats.

E 3362. Dhupgúri, W. Dúars, Bengal (Gamble).
D 4151. Bollapalle Reserve, Kistna (Gamble).
Sind—Kew Museum (Stocks).

Subgenus 2. FLUEGGEOPSIS. *P. glaucus*, Wall.; Fl. Br. Ind. v. 288, is a shrub of the Central and Eastern Himalaya and the Khasia Hills at 4–5000 ft.

Subgenus 3. EMBLICA.

P. albizzioides, Hook. f.; Fl. Br. Ind. v. 289 (*Cicca albizzioides*, Kurz For. Fl. ii. 352); Vern. *Shama*, Burm., is a small tree of the upper mixed forests of the Pegu Yoma, up to 2000 ft. *P. pomiferus*, Hook. f.; Fl. Br. Ind. v. 289 (*C. macrocarpa*, Kurz For. Fl. ii. 352); Vern. *Zibyu*, Burm., is a small tree of the Eng and dry forests of Pegu in Burma, and the Shan Hills. *P. Prainianus*, Coll. and Hemsl. in Journ. Linn. Soc. xxviii. 123, is a small tree of the Shan Hills at 5000 ft. resembling *P. Emblica*.

2. P. Emblica, Linn.; Fl. Br. Ind. v. 289; Roxb. Fl. Ind. iii. 671; Bedd. Fl. Sylv. t. 258; Brandis For. Fl. 454, t. 52; Gamble Darj. List 69; Talbot Bomb. List 178; Trimen Fl. Ceyl. iv. 19. *Cicca Emblica*, Kurz For. Fl. ii. 352. Vern. *Ambal*, *ambli*, Pb.; *Daula*, *amla*, *amlika*, *aura*, *aola*, *aunra*, Hind.; *Aonla*, *imli*, Kashmir; *Aunla*, Nep.; *Suam*, Lepcha; *Amla*, *ambolati*, *amulati*, Beng.; *Ambari*, Gáro; *Owla*, Mechi; *Amluki*, Ass.; *Aolay*, Melghát; *Onra*, *ounla*, Uriya; *Alá thanda*, Cuttack; *Nilli*, *milli*, *nalli*, *aunri*, *usir*, *lalla*, Gondi; *Aunre*, Kurku; *Meral*, Kól, Sonthal; *Durga*, Khond; *Usiriki*, Reddi; *Usiri*, Koya; *Nelli*, *nellekai*, *toppinelli*, Tam.; *Osirka*, *usri*, *asereki*, *usirika*, *amala kamu*, *usari*, Tel.; *Nelli*, *nilika*, Kan.; *Ohalu*, *gondhona*, Uriya; *Aonli*, *awla*, Mar.; *Nelli*, Cingh.; *Nasha*, *tasha*, Burm.

A moderate-sized deciduous tree. *Bark* somewhat less than ½ in. thick, light grey, exfoliating in small irregular patches, inner substance red. *Wood* red, hard, close-grained, warps and splits in seasoning; no heartwood; *annual rings* not distinct. *Pores* small and moderate-sized, uniformly distributed, often subdivided or in short radial lines. *Medullary rays* moderately broad and broad, the distance between two rays generally greater than the transverse diameter of the pores; silver-grain prominent.

Almost throughout India and Burma, rising in the hills to 4000 ft., chiefly in deciduous dry forests; dry region and patana lands of Ceylon.

A pretty and ornamental tree, but of not much importance, though giving a good fuel and useful in coppice forests, as it reproduces freely from the root. The wood makes good poles, and is useful for agricultural implements, building and furniture; it is durable under water and can be used for well-work. The rate of growth is difficult to make out. Aikin in Wallich's List gives 2·7 rings per inch of radius, which is probably too fast; 4 to 5 would be nearer.

The weight and transverse strength have been determined by the following experiments:—

Experiment by whom made.	Year.	Wood whence procured.	Weight.	No. of experiments.	Size of bar used.	Value of P.
			lbs.		ft. in. in.	
Puckle	1859	Mysore	67	2	2 × 1 × 1	975 (?)
Kyd	1831	Assam	45	—	—	617
Skinner, No. 105	1862	South India	46	—	—	562
Cunningham	1854	Gwalior	46	2	2 × 1 × 1	559
R. Thompson	1868	Central Provinces	45	—	—	—
A. Mendis	1855	Ceylon	49	—	—	—
Brandis (No. 98)	1862	Burma	35	—	—	—
Specimens examined	1900	Different Provinces	52	11	—	—
Bourdillon	1896	Travancore	42	—	—	514

The bark and leaves are used for tanning and in medicine; chips of the wood are said to clear muddy water. The fruit is the *Emblic Myrobolan*, and is used as a medicine, for dyeing, tanning, and for food and preserves. It gives a gum, which is not used.

			lbs.
P	104.	Bhajji, Simla, 3000 ft.	56
P	438.	Ajmere	—
O	252.	Garhwal (1868)	49
O	539.	Dehra Dún (O'Callaghan)	48
E	580.	Khookloong Forest, Darjeeling Terai (Manson)	56
E	2432.	Bamunpokri, Darjeeling Terai (Gamble)	48
C	1126.	Ahiri Reserve, Central Provinces (R. Thompson)	51
C	2738.	Moharli Reserve, Central Provinces (Brandis)	56
C	841.	Bairagarh Reserve, Berar (Drysdale)	45
C	2774.	Melghát, Berar (Brandis)	—
C	3539.	Khurdha Forests, Orissa (Gamble)	58
D	4310.	Seshachellam Hills, Cuddapah (Higgens)	52
No.	61,	Ceylon Collection, old; 103, new (Mendis)	56

Nordlinger's Sections, vol. 10 (Tab. XII. 3).

Subgenus 4. PARAPHYLLANTHUS. Four species. *P. Lawii*, Grah.; Fl. Br. Ind. v. 290; Talbot Bomb. List 178 (*P. juniperinoides*, Muell. Arg.; Bedd. Fl. Sylv. exc.) is a straggling shrub of the banks of rivers in the Peninsula. *P. bœobotryoides*, Wall.; Fl. Br. Ind. v. 291; Kurz For. Fl. ii. 348, is an evergreen shrub of Sylhet and Burma; and *P. columnaris*, Muell. Arg.; Fl. Br. Ind. v. 291; Kurz For. Fl. ii. 347, a small deciduous tree of the mixed forests in Burma, chiefly along rivers.

3. P. polyphyllus, Willd.; Fl. Br. Ind. v. 290; Bedd. Fl. Sylv. exc.; Trimen Fl. Ceyl. iv. 20.

A shrub or small tree. *Bark* dark grey, peeling off in roundish flakes, showing a light grey under-surface, very thin. *Wood* white, hard, close-grained. *Pores* small, numerous, between the fine to moderately broad, numerous *medullary rays*.

Hilly country of the Deccan and Carnatic; dry region of Ceylon.

D 4164. Mantralama Pass, Kurnool (Gamble).

Subgenus 5. EUPHYLLANTHUS. *P. parvifolius*, Ham. is a very small shrub frequently found on rocks in the West Himalaya. The Fl. Br. Ind. says it reaches 6 to 8 ft., but I have never seen it anything near so big. *P. myrtifolius*, Moon; Fl. Br. Ind. v. 296; Trimen Fl. Ceyl. iv. 22, is a large ornamental shrub found endemic near streams in Ceylon. *P. Leschenaultii*, Muell. Arg. is a shrub of the Khasia Hills at 5000 ft.; also found in the Nilgiris.

Subgenus 6. CICCA.

4. P. distichus, Muell. Arg.; Fl. Br. Ind. v. 304; Bedd. Fl. Sylv. cxci.; Talbot Bomb. List 178. *P. longifolius*, Roxb. Fl. Ind. iii. 672. *Cicca disticha*, Kurz For. Fl. ii. 353. Vern. *Loda, nori*, Beng.; *Harfaruri, chalmeri*, Hind.; *Russa usareki*,

Tel.; *Arunelli*, Tam.; *Kirnelli*, Mysore; *Harparawri, raiavala*, Mar.; *Thinbawzibyu*, Burm.

A deciduous tree. *Bark* grey, smooth. *Wood* light brown, moderately hard. *Pores* small, numerous, in radial lines between the fine to moderately broad, numerous, regular but short *medullary rays*.

Gardens in the hotter parts of India.

A fruit tree, occasionally found in cultivation, but not very common.

Java—Kew Museum (Scheffer).

SUBGENUS 7. PROSORUS. *P. indicus*, Muell. Arg.; Fl. Br. Ind. v. 305; Bedd. Fl. Sylv. cxci.; Talbot Bomb. List 178; Trimen Fl. Ceyl. iv. 27; Vern. *Karawu*, Cingh., is a small tree of the Western Ghâts from the Konkan southwards, also found in Ceylon, and said by Trimen to have a white tough wood. *P. cyanospermus*, Muell. Arg.; Fl. Br. Ind. v. 305; Trimen Fl. Ceyl. iv. 27; Vern. *Sudu-uijan, kulu-niyan*, Cingh., is a similar tree also found in Ceylon, and distinguished by "brilliant metallic 'blue seeds."

P. Wightianus, Muell. Arg.; DC. Prod. xv. ii. 334 (*Chorizandra pinnata*, Wight Icon. t. 1994), is a somewhat gregarious shrub of laterite soils in Kurnool, the Circars, Nellore and Chingleput, especially on the western side of the Pulicat Lake (Wight). It has been erroneously included in Fl. Br. Ind. under *Flueggia microcarpa*. It belongs to Mueller's Subgenus *Chorizandra*.

9. GLOCHIDION, Forst.

A large genus of about 45 to 50 evergreen trees and shrubs, only a few of which are at all common or of any forest importance, the rest being chiefly rather rare trees of the evergreen wet forests. About 13 species occur in the Himalaya, of which 3 or 4 extend to the west of Nepal; about 16 species are found in Burma; about 12 species are met with in South and West India, and 9 species in Ceylon. It is unnecessary here to mention more than a few, in addition to those whose woods are described. *G. multiloculare*, Muell. Arg.; Fl. Br. Ind. v. 307; Kurz For. Fl. ii. 343; Gamble Darj. List 69 (*Bradleia multilocularis*, Roxb. Fl. Ind. iii. 696), is a shrub or small tree of grass lands in the sub-Himalayan tract from the Ganges eastwards, found in the forests of Oudh, the Sikkim Terai and Behar, Assam, Sylhet and Upper Burma. In the Darjeeling Terai and Western Dúars are also found *G. Gamblei*, Hook. f., *G. hirsutum*, Muell. Arg., and *G. Heyneanum*, Wight, the last-named said to extend southwards to the Circars; while in the Darjeeling Hills occur, besides *G. acuminatum*, Muell. Arg., *G. nubigenum*, Hook. f., a rather large tree of the forests at 5-7000 ft. The most noticeable of the Burmese species is perhaps *G. coccineum*, Muell. Arg.; Fl. Br. Ind. v. 308; Kurz For. Fl. ii. 342; Vern. *Tamasôk*, Burm., a tree of the deciduous forests, while *G. fagifolium*, Miq.; Fl. Br. Ind. v. 312; Bedd. Fl. Sylv. cxciii.; Kurz For. Fl. ii. 345; Vern. *Tamasôkkyi*, Burm., is found in the tropical forests and extends to Chittagong and across the bay to the Nilgiris. In South India, *G. zeylanicum*, A. Juss.; Fl. Br. Ind. v. 310; Bedd. Fl. Sylv. cxcii.; Talbot Bomb. List 179; Trimen Fl. Ceyl. iv. 28; Vern. *Hunu-kirilla*, Cingh., is a small tree found from the Konkan and Circars southwards as well as in Assam and in Ceylon, both in evergreen and deciduous forests. *G. arboreum*, Wight and *G. malabaricum*, Bedd. are also not uncommon in the hills of South India. In Ceylon the most noticeable species is *G. Moonii*, Thw.; Fl. Br. Ind. v. 325; Trimen Fl. Ceyl. iv. 32; Bedd. Fl. Sylv. cxcvi. (also *G. glaucogynum*, Bedd.); Vern. *Be-hunukirilla*, a small tree common in the moist region up to 4000 ft.

Wood red or reddish-brown, moderately hard. *Pores* moderate-sized or small, scanty, in radial lines between the fine *medullary rays*.

1. G. lanceolarium, Dalz.; Fl. Br. Ind. v. 308; Bedd. Fl. Sylv. cxcii.; Kurz For. Fl. ii. 343; Gamble Darj. List 69; Talbot Bomb. List 178. *Phyllanthus lanceolarius*, Muell. Arg.; Brandis For. Fl. 452. *Bradleia lanceolaria*, Roxb. Fl. Ind. iii. 697. Vern. *Bhoma*, Mar.; *Bangikat*, Nep.; *Fagiri*, Lepcha; *Angúti*, Sylhet; *Bhauri*, Beng.; *Tsekoban*, Magh; *Kalchua*, Uriya; *Lodam*, Sonthal; *Marangmata*, Kól.

A small or moderate-sized evergreen tree. *Bark* brown or grey, soft, cleft longitudinally. *Wood* reddish-brown, moderately hard.

Pores small and moderate-sized, scanty, in radial lines between the fine *medullary rays.*

Sub-Himalayan tract from Dehra Dún eastwards to Assam and up to 5000 ft.; Sylhet and Chittagong; Chota Nagpore, Orissa and the Circars; Shan Hills of Burma. Chiefly found in moist places and ravines, a pretty wood.

		lbs.
C 3485.	Kolhán Forests, Chota Nagpore (Gamble)	—
C 3501, 3553.	Khurdha Forests, Orissa „	56

2. **G. neilgherrense,** Wight; Fl. Br. Ind. v. 316; Bedd. Fl. Sylv. t. 277 (including *G. Perrottetianum*, Bedd. Fl. Sylv. cxciv.). Vern. *Hanikay*, Badaga.

A moderate-sized tree. *Bark* reddish-brown, thin, peeling off in flat flakes. *Wood* red, often bright-coloured, moderately hard. *Pores* moderate-sized, often subdivided and in radial lines between the fine to moderately broad *medullary rays,* which show a pretty silver-grain.

Nilgiri Hills above 6000 ft., a common tree in the shola forests.

The wood is not in special use, but would be good for turning and cabinet-work. Growth 7 to 8 rings per inch of radius.

		lbs.
W 3878.	Aramby, Ootacamund, 7000 ft. (Gamble)	47
W 4124.	Lovedale „ „ „	59

3. **G. velutinum,** Wight; Fl. Br. Ind. v. 322; Bedd. Fl. Sylv. cxcv.; Gamble Darj. List 69; Talbot Bomb. List 179. *G. nepalense*, Kurz For. Fl. ii. 344. *Phyllanthus nepalensis*, Muell. Arg.; Brandis For. Fl. 452. Vern. *Gol kamela, gúrsawa, sama, chamár kas, amblu, kalma, kodmil*, Pb.; *Mowa, bakalwa*, N.-W. Provinces; *Anwin*, Jaunsar; *Chamari*, Dehra Dún; *Katu manwa, katmaba, bakalwa*, Garhwal; *Kari, koria*, C.P.; *Dhair maba*, Kumaon; *Kolia*, Berar; *Latikat*, Nep.

A small or moderate-sized tree. *Bark* brown, rough. *Wood* dark red when seasoned and old, lighter when young and freshly cut, hard, rough. *Pores* moderate-sized, rather scanty, often subdivided. *Medullary rays* moderately broad, equidistant, giving a nice silver-grain.

Outer Himalaya and sub-Himalayan tract from the Indus to Assam, rising to 4000 ft.; Khasia Hills; Upper Burma; Central India and Deccan; Western Gháts from the Konkan to the Nilgiris.

A common tree in the deciduous forests, but except for fuel the wood is not used. The bark is said to be used for tanning. The leaves are not eaten by goats (Gleadow).

		lbs.
O 4811.	Dehra Dún (Gamble)	38
O 4823.	Thano, Dehra Dún (Gleadow)	40
E 2434.	Bamunpokri, Darjeeling Terai (Gamble)	42

4. **G. acuminatum,** Muell. Arg.; Fl. Br. Ind. v. 323; Gamble Darj. List 69, *Phyllanthus bicolor*, Muell. Arg.; Brandis For. Fl. 453. Vern. *Latikat*, Nep.; *Kair, tetrikair*, Lepcha.

An evergreen tree. *Bark* very thin, grey. *Wood* red or reddish-grey, hard. *Pores* small and moderate-sized, uniformly distributed. *Medullary rays* fine and moderately broad, numerous, giving a prominent and pretty silver-grain on a radial section.

Eastern Himalaya, in Nepal and Sikkim at 5–7000 ft.; Khasia Hills at 4–6000 ft.

A tree of the forests of the Upper Darjeeling Hills. The wood unfortunately splits rather badly, but it is a handsome one and might be useful in turnery.

		lbs.
E 685.	Sepoydura Forest, Darjeeling, 5500 ft. (Johnston)	37
E 2433.	Tukdah Forest, Darjeeling, 6000 ft. (Gamble)	47

Nordlinger's Sections. vol. 10 (*Phyllanthus bicolor*).

No. 54, Ceylon Collection, new, is called *G. coriaceum*. Vern. *Hunukirilla*. Trimen gives *Hunukirilla* as the name of *G. zeylanicum*. The wood specimen is a piece of soft white wood soaked in wax, and its structure has no resemblance to that of any of the specimens of other Glochidions. It is mentioned to indicate the danger of too easily accepting specimens as correctly identified.

10. FLUEGGIA, Willd.

Two species. *F. Leucopyrus*, Willd.; Fl. Br. Ind. v. 328; Talbot Bomb. List 180; Trimen Fl. Ceyl. iv. 33 (*Securinega Leucopyrus*, Muell. Arg.; Bedd. Fl. Sylv. cxcvii.; Brandis For. Fl. 456, t. 54, *Phyllanthus Leucopyrus*, Roxb. Fl. Ind. iii. 658, *Cicca Leucopyrus*, Kurz For. Fl. ii. 353); Vern. *Perei pastawane*, Afgh.; *Karkún, rithei, girthan, gargas, bháthi, báta, vanúthi, girk*, Pb.; *Hartho, ainta*, Hind.; *Kiran*, Sind; *Challa manta, sale manta*, C.P.; *Vorepuvan*, Mar.; *Salapan*, Merwara; *Mudpulanti*, Tam.; *Tella púrúgúdú*, Tel.; *Hin-katupila*, Cingh., is a large straggling thorny shrub of the dry regions of the Punjab, Sind, Guzerat, the Deccan, Carnatic and Ceylon, extending to Upper Burma, noticeable for its white fruits and having a close-grained hard wood.

1. **F. microcarpa**, Blume; Fl. Br. Ind. v. 328; Gamble Darj. List 70; Talbot Bomb. List 178. *Securinega obovata*, Muell. Arg.; Bedd. Fl. Sylv. cxcvii.; Brandis For. Fl. 455. *Cicca obovata*, Kurz For. Fl. ii. 354. *Phyllanthus retusus* and *P. virosus*, Roxb. Fl. Ind. iii. 657, 659. Vern. *Dalme, dhúni, bakarcha, ghari, gwala, darim*, Hind.; *Rithoul*, Dehra Dún; *Achal*, Nep.; *Iktibi*, Lepcha; *Ukieng, thaka*, Mechi; *Kodarsi*, Mar.; *Korchi*, Gondi; *Yechinya*, Burm.

A small deciduous tree or large shrub. *Bark* smooth, thin, rusty or reddish-brown. *Wood* red, hard, close-grained. *Pores* small, fairly numerous, in short radial lines. *Medullary rays* fine, numerous, regular, the distance between the rays greater than the transverse diameter of the pores.

Lower Himalaya and sub-Himalayan tract from Kashmir to Bhutan, ascending to 5000 ft.; Assam, Bengal and Burma; Central, Western and Southern India, especially in hill forests.

A graceful little tree of slow growth. The wood is used for agricultural implements. The bark is astringent and used to intoxicate fish. I have some doubt about specimens H 2941 and P 3247, which may belong to *F. Leucopyrus*.

		lbs.
H 2941.	Jander, Sutlej Valley, Simla, 3000 ft. (Gamble)	52
P 3247.	Ajmere	—
O 4741.	Kasumri, Saharanpur (Gradon)	54
E 3319.	Pankabari, Darjeeling, 2000 ft. (Gamble)	—
E 3282.	Sitapahar, Chittagong (Gamble)	—

11. BREYNIA, Forst.

Three or four species. *B. angustifolia*, Hook. f.; Fl. Br. Ind. v. 330, is a shrub of Burma, as is *Melanthesopsis fruticosa*, Muell. Arg.; Kurz For. Fl. ii. 349, which Kurz describes as found in the drier hill forests, especially the pine forests, of Martaban, at 2–4000 ft.

1. **B. patens**, Benth.; Fl. Br. Ind. v. 329; Talbot Bomb. List 180; Trimen Fl. Ceyl. iv. 33. *Melanthesopsis patens*, Muell. Arg.; Bedd. Fl. Sylv. cxcvi.; Brandis For. Fl. 455; Kurz For. Fl. ii. 348; Gamble Darj. List 70. *Phyllanthus patens*, Roxb. Fl. Ind. iii. 667. Vern. *Ikti*, Lepcha; *Wal murunga*, Cingh.

A shrub. *Bark* yellow, thin, smooth. *Wood* white, hard, close-grained. *Pores* small, regular, evenly distributed. *Medullary rays* moderately hard, regular, long, wavy, conspicuous.

Lower Himalaya and sub-Himalayan tract from Nepal eastward; Eastern Bengal; Burma: Deccan Peninsula, Ceylon: chiefly in dry, scrub forests.

D 4169. Mellavagu, Kistna (Gamble).

2. B. rhamnoides, Muell. Arg.; Fl. Br. Ind. v. 330; Bedd. Fl. Sylv. cxcvi.; Brandis For. Fl. 456; Kurz For. Fl. ii. 350; Talbot Bomb. List 180; Trimen Fl. Ceyl. iv. 34. *Phyllanthus Vitis-idæa,* Roxb. Fl. Ind. iii. 665. Vern. *Tikhar,* Hind.; *Kamkata juli,* Beng.; *Harra séjum,* Kól; *Sikat,* Kharwar; *Mahkoá,* Monghyr; *Yellari, yerra púrúgúdú,* Tel.; *Manipulnati,* Tam.; *Gônnyinya,* Burm.; *Gas-kayila,* Cingh.

A small tree. *Bark* greyish-brown, rough. *Wood* reddish-brown, hard, close-grained. *Pores* small, evenly distributed. *Medullary rays* fine, numerous.

Forests of Oudh, C.P. and Central India generally, and southwards and westwards, also frequently in hedges and open scrub lands; savannah lands of Burma; Ceylon.

C 3451. Betlah Reserve, Palamow (Gamble).
D 3847. Horsleykonda, Cuddapah, 4000 ft. (Gamble).

12. SAUROPUS, Blume. Small shrubs. *S. albicans,* Blume; Fl. Br. Ind. v. 332; Kurz For. Fl. ii. 349; Gamble Darj. List 70; Trimen Fl. Ceyl. iv. 16 (*Phyllanthus strictus,* Roxb. Fl. Ind. iii. 670); Vern. *Sengtungrúng,* Lepcha; *Yaungmakinnyo,* Burm.; *Mella-dum-kola,* Cingh., is a small shrub of the Sikkim Himalaya, Eastern Bengal, South India, Burma and Ceylon. *S. trinervius,* Muell. Arg.; Fl. Br. Ind. v. 334, is described as a "shrub or bushy tree, 12 ft.," from the Sikkim Himalaya, Eastern Bengal, and the Khasia Hills; while *S. compressus,* Muell. Arg.; Fl. Br. Ind. iv. 336; Kurz For. Fl. ii. 350, is described as a "deciduous-leaved tree or large shrub" from the Central and Eastern Himalaya and Burma. These three are fairly large, the rest are quite small species.

13. PUTRANJIVA, Wall.

1. P. Roxburghii, Wall.; Fl. Br. Ind. v. 336; Bedd. Fl. Sylv. t. 275; Brandis For. Fl. 451, t. 53; Kurz For. Fl. ii. 366; Talbot Bomb. List 180; Trimen Fl. Ceyl. iv. 35. *Nageia Putranjiva,* Roxb. Fl. Ind. iii. 766. Vern. *Putájan,* Pb.; *Jiapúta, joti, júti, pútra-jiva, patji, jivputrak, pútigia,* Hind.; *Pichaunjia,* Monghyr; *Paichandia,* Uriya; *Veku,* Reddi; *Karupale, vitchu-runai, karippalai,* Tam.; *Kadrajuvi,* Tel.; *Pongalam,* Mal.; *Jewan-putr,* Mar.; *Putra jivi,* Kan.; *Taukyat, daukyat, badibyu,* Burm.

A moderate-sized evergreen tree with pendent branches. *Bark* dark grey, whitish when young, with numerous horizontal oblong lenticels. *Wood* grey, moderately hard, close-grained. *Annual rings* marked by prominent concentric lines. *Pores* small to moderate-sized, scanty, subdivided or in short radial lines, between closely packed, uniform, fine *medullary rays,* which bend round the pores. Very numerous, very fine transverse bars, joining the rays, as in *Anonaceæ.*

Sub-Himalayan tract from the Chenab eastward, extending thence into both Peninsulas and to Ceylon, but scarce in the latter, as in Assam and Burma; often cultivated.

This pretty evergreen tree is found along river-banks, in shady valleys and evergreen forests. In Northern India it usually grows bushy and much branched, but in South India, especially in the forests of the Eastern Ghâts, it grows to a much larger size. Beddome speaks of it as a "large timber tree," a description I should hardly have myself adopted, and I have frequently found it in the region he refers to. Beddome speaks of the wood as adapted for the lathe, and Brandis says it is used in places for tools and in turning. The average weight is about 49 lbs.; Wallich puts it at 36·6 lbs. The nuts are white, rugose, ovoid; they are "strung up in rosaries and 'in necklaces for children to keep them in health, whence the name 'life of the child'" (Brandis). The leaves are lopped for fodder.

		lbs.
O 1459.	Bahraich, Oudh	48
O 1477.	Gonda, Oudh (Wood)	49
E 2469.	Royal Botanic Garden, Calcutta (King)	48
C 3990.	Rekapalle Forests, Godavari (Gamble)	51

Nordlinger's Sections, vol. 10.

2. **P. zeylanica,** Muell. Arg.; Fl. Br. Ind. v. 337; Bedd. Fl. Sylv. cxcvii.; Trimen Fl. Ceyl. iv. 35. Vern. *Pelan, pelanga,* Cingh.

A glabrous evergreen tree. *Bark* pale, smooth. *Wood* greyish-brown, moderately hard. *Pores* moderate-sized, more numerous and more regularly distributed than in *P. Roxburghii. Medullary rays* fine to moderately broad, wavy. Transverse bars more prominent though fewer than in *P. Roxburghii.*

Moist low country of Ceylon.

Trimen speaks of this tree as very rare; Mendis says it is a very handsome tree, whose wood is used for rafters and battens in house-building.

No. 112, Ceylon Collection, new (Mendis).

14. HEMICYCLIA, W. and A.

Eight or nine species, all trees, and even large trees, though one, *H. sepiaria,* W. and A., is more usually found in a shrubby condition. *H. Gardneri,* Thw.; Fl. Br. Ind. v. 338; Bedd. Fl. Sylv. cxcviii.; Trimen Fl. Ceyl. iv. 37, t. 82. Vern. *Gal-wira, eta-wira,* Cingh., is a small tree of the dry region of Ceylon. *H. sumatrana,* Muell. Arg.; Fl. Br. Ind. v. 338; Kurz For. Fl. ii. 365, is an evergreen tree of swamp forests and marshy places along streams in Burma, with, according to Kurz, a heavy, pale greyish-brown, close-grained wood. *H. andamanica,* Kurz; Fl. Br. Ind. v. 338; Kurz For. Fl. ii. 365, is an evergreen tree of marshy places on the coast of the Andaman Islands. *H. elata,* Bedd. Fl. Sylv. t. 279; Fl. Br. Ind. v. 339, is a large tree, reaching 100 ft. in height, found in the forests of the Wynaad at 2–4000 ft., also in those of the Anamalai Hills and in Tinnevelly, and said by Beddome to have a strong wood much used for building. It should, however, be noted that Hooker thinks it indistinguishable from *H. venusta,* Thw. *H. Wightii,* Hook. f.; Fl. Br. Ind. v. 339, is a tree of the Nilgiri Hills.

Wood white, or creamy white, or greyish-white, hard, close-grained, with the texture of boxwood. *Pores* scanty, small or very small. *Medullary rays* fine, numerous. Minute ladder-like bars as in *Putranjiva* in some species.

1. **H. sepiaria,** W. and A.; Fl. Br. Ind. v. 337; Bedd. Fl. Sylv. cxcviii.; Talbot Bomb. List 181; Trimen Fl. Ceyl. iv. 36. Vern. *Virai,* Tam.; *Wira,* Cingh.

A small tree or large branching evergreen shrub. *Bark* grey, thin, smooth. *Wood* white with a greyish-brown heartwood, very hard, close- and even-grained, resembling boxwood. *Pores* small, very scanty, unevenly distributed. *Medullary rays* fine, regular, very numerous. Numerous minute, fine, pale ladder-like bars joining the rays as in *Putranjiva* (as, also, in *Anonaceæ*).

Dry evergreen forests of the Deccan, Carnatic and Konkan, also of the dry region of Ceylon.

A characteristic plant of the dry evergreen forests, perhaps almost the most common species in the Carnatic, as it is, according to Trimen, in Ceylon. The wood might serve as a substitute for boxwood. It is commonly cut for fuel in the Carnatic, and is important in the sylviculture of the dry forests. The fruit is eaten in Ceylon.

		lbs.
D 4123.	Ballipalle Forest, Cuddapah (Gamble)	58
D 4176.	Nallamalai Hills, Kurnool „	67

2. **H. lanceolata,** Thw.; Fl. Br. Ind. v. 338; Bedd. For. Fl. cxcviii.; Trimen Fl. Ceyl. iv. 37.

A moderate-sized evergreen tree. *Wood* greyish-white, hard, close-grained. *Pores* scanty, very small. *Medullary rays* very fine, very numerous. Alternate bands of light and dark wood rather faint.

Travancore Forests; moist region of Ceylon.

Trimen and Hooker mention this as endemic in Ceylon, but Bourdillon's determination is probably accurate. He gives W = 57 lbs. and P = 527.

	lbs.
W 4610. Travancore (Bourdillon)	48

3. **H. venusta,** Thw.; Fl. Br. Ind. v. 339; Bedd. Fl. Sylv. cxcviii.; Talbot Bomb. List 181. Vern. *Vellelambu*, Tam.; *Vella kasavu*, Mal.

A small evergreen tree. *Wood* dark grey, hard, close-grained. *Pores* small, often subdivided or in radial strings. *Medullary rays* fine, very numerous. Alternate bands of light and dark tissue, more prominent than in *H. lanceolata.*

South India from the Konkan and Circars through the hills to Travancore and Tinnevelly, up to 4000 ft.

Bourdillon gives W = 51 lbs., P = 726, and says that the wood cracks a good deal.

	lbs.
W 4601. Travancore (Bourdillon)	51

4. **H. Porteri,** Gamble in Hook. Icon. Pl. ser. iv. vol. viii. pl. 2701. Agilwood.

A small evergreen tree. *Bark* grey, very thin, peeling off in broad flakes. *Wood* yellowish-white, sapwood lighter, very closely resembling that of *H. sepiaria. Pores* very small, very scanty, unevenly distributed. *Medullary rays* very fine, very numerous, wavy. Numerous minute, fine, pale, ladder-like bars, exactly as in *H. sepiaria.*

Carnatic, gregarious near streams in Madura District.

The wood is of good quality and used for house-posts, rafters, poles, etc.

	lbs.
D 4805. Warsanad Valley, Madura, 2000 ft. (H. J. Porter)	61

15. CYCLOSTEMON, Blume.

About 13 species, mostly trees or small trees of the evergreen forests or of shady ravines and swamps. *C. indicus*, Muell. Arg.; Fl. Br. Ind. v. 340 is a tree of the southern slopes of the Khasia Hills in the wet forests. *C. lancifolius*, Hook. f.; Fl. Br. Ind. v. 340; Gamble Darj. List 70; Vern. *Bwaychamp*, Nep., is also a tree of the Khasia Hills at 3–5000 ft., extending to the Sikkim Himalaya up to 5000 ft. It is said to have wood resembling that of *Michelia*. *C. malabaricus*, Bedd. Fl. Sylv. cxcix.; Fl. Br. Ind. v. 341, is a large tree of the Tinnevelly Ghâts; and *C. confertiflorus*, Hook. f.; Fl. Br. Ind. v. 341; Talbot Bomb. List 181, a tree of the evergreen forests near the Devimone Ghât in N. Kanara. *C. eglandulosus*, Kurz For. Fl. ii. 364; Fl. Br. Ind. v. 341, is a tree of the tropical forests of Arracan, extending north to Chittagong and Tippera; while *C. subsessilis*, Kurz For. Fl. ii. 364; Vern. *Ban-bokal*, Beng., is a tree of the undergrowth in the great evergreen forests of Chittagong, Arracan and Martaban, as well as in the Sundarbans. There are also two uncommon Burmese species, as well as one from the Andaman and one from the Nicobar Islands.

Wood light brown, hard. *Pores* single or in patches, which are often oblique, causing a resemblance to the wood of *Castanopsis. Medullary rays* regular. Transverse bars very minute, but regular.

1. **C. Griffithii,** Hook. f.; Fl. Br. Ind. v. 340. Vern. *Thitègyin*, Burm.

A large tree. *Wood* light brown, hard. *Pores* moderate-sized to large, sometimes resinous, arranged in more or less radial patches, which are often branched or deflected, very prominent on all vertical sections and causing the wood to look like that of *Castanopsis. Medullary rays* fine to very fine, numerous, not prominent. Faint cross-bars joining the rays.

Forests of Upper Burma, extending to the Mishmi Hills in Assam.

J. W. Oliver says it gives one of the most valuable timbers in the hills.

		lbs.
B 4748.	Ruby Mines, Burma (J. Nisbet)	53

2. **C. macrophyllus,** Blume; Fl. Br. Ind. v. 340; Bedd. Fl. Sylv. t. 278; Kurz For. Fl. ii. 364; Trimen Fl. Ceyl. 38.

An evergreen tree. *Bark* grey, rugose. *Wood* yellowish-brown, hard. *Pores* moderate-sized, scanty, arranged in more or less radial, often deflected, patches. *Medullary rays* fine, numerous, wavy. Faint cross-bars between the rays caused by alternate bands of loose and firm cellular tissue.

Evergreen moist forests of the Western Gháts, in Coorg, the Anamalai Hills and Travancore up to 4000 ft.; Andaman Islands and Ceylon.

		lbs.
W 4713.	Travancore (Bourdillon)	53

3. **C. assamicus,** Hook. f.; Fl. Br. Ind. v. 342; Gamble Darj. List 70. Vern. *Ban bokul*, Beng.; *Bway champ, asura*, Nep.; *Khad-behúla*, Kumaon; *Chipla*, Dehra Dún.

A small tree. *Bark* greyish-white, granular, faintly cleft vertically, very thin. *Wood* light brown, hard. *Pores* moderate-sized, scanty, often subdivided. *Medullary rays* fine to moderately broad, regular. Very fine, minute transverse bars numerous and regular.

Sub-Himalayan tract from the swampy forests of the Dehra Dún eastwards to the Darjeeling Terai and Assam; Khasia Hills; hills of the Circars; always in forest undergrowth in damp places.

		lbs.
O 4837.	Dehra Dún (Babu U. N. Kanjilal)	52

16. MISCHODON, Thw.

1. **M. zeylanicus,** Thw.; Fl. Br. Ind. v. 344; Bedd. Fl. Sylv. t. 290; Trimen Fl. Ceyl. iv. 38. Vern. *Tampanai*, Tam.; *Tammanua*, Cingh.

A large tree. *Bark* brown, rough. *Wood* pink or pinkish-white, moderately hard, close- and even-grained. *Pores* small, often subdivided, scanty. *Medullary rays* fine, numerous, regular. *Annual rings* faint.

Hills of Tinnevelly; Ceylon.
The wood is used for building in Ceylon, and said to be durable in water.

		lbs.
W 4295.	Tinnevelly (Brasier)	38
	No. 131, Ceylon Collection, new (Mendis).	

17. BISCHOFIA, Blume.

1. **B. javanica,** Blume; Fl. Br. Ind. v. 345; Bedd. Fl. Sylv. t. 259; Brandis For. Fl. 446; Kurz For. Fl. ii. 355; Gamble Darj. List 70; Talbot Bomb. List 181. *Andrachne trifoliata*, Roxb. Fl. Ind. iii. 728. Vern. *Paniála, bhillar*, Dehra Dún; *Kot-semla, kaen, kein*, Garhwal; *Pun, kein, korsa*, Kumaon; *Irúm*, Oudh; *Kainjal*, Nep.; *Sinong*, Lepcha; *Taisoh, urúm*, Mechi; *Uriám*, Ass.; *Joki*, Cachar; *Bolzuru*, Gáro; *Boke*, Mar.; *Thondi, malachithiyan*, Tam.; *Gobra nairúl*, Kan.; *Govarnellu*, Hassan; *Nira*, Mal.; *Nannal, thiripu*, Trav. Hills; *Modagerri vembu*, Tinnevelly; *Boaungza*, Burm.

A deciduous tree. *Bark* rough, dark grey with a brown tinge, exfoliating in angular scales. *Wood* red, rough, moderately hard, heartwood darker, having a strong scent of vinegar when fresh cut. *Pores* moderate-sized to large, often subdivided or in short radial lines, sometimes filled with resin. *Medullary rays* of two classes, broad and fine, several fine rays between each pair of broad, wavy, dark-coloured.

Lower Himalaya up to 4000 ft., and sub-Himalayan tract, from the Jumna eastwards; Oudh and Gorakhpur; Bengal and Assam; Western Ghâts from N. Kanara southwards; Circars and hills of Deccan and Carnatic; throughout Burma.

A characteristic tree of shady ravines, of swamps and river-banks and of valleys in the hills, but it is also often found on hillsides on the damper aspects up to perhaps 4000 ft. The growth is fast, sometimes as fast as 4 rings per inch of radius. S. E. Peal says of it, "This tree, of which the Assam Rajas used sometimes to have their 'coffins made, seems to grow almost equally well in high or low land, and is common 'on the flats near rivers. Assamese were, I am told, not allowed to cut it formerly. 'It attains a girth of 6 to 8 ft.; but the bole is rather short, running to 30 or 40 ft.; 'the stem is seldom straight. It has a large and dense crown of rather dark foliage" (*Ind. Tea Gaz.*).

The wood is of good quality, and is largely used in Assam for bridges and other works of construction. Chev. Paganini, in *Timber Trades Journal*, says that although above ground it warps and cracks and white ants attack it, in wet ground or under water it is almost imperishable, so that it is particularly suited for pile foundations and railway sleepers. Beddome says that in the Nilgiris it is used for building, and sometimes called "Red Cedar." Kyd gives W = 43 lbs., P = 617; Bourdillon gives W = 52 lbs., P = 745; Kurz evidently identifies it with No. 99 of Brandis' 1862 List, Burm. *Yagine*, and puts the weight at 35 lbs., and breaking weight 153 to 170 lbs.; the specimens examined give an average of 45 lbs. for the weight, which may, on the whole, be taken as approximately correct. Peal thinks the wood too heavy for tea-boxes. Graham Anderson says it is a good tree to shade coffee. Wild tells me he has found it on sale in Darjeeling bazars as "Toon."

		lbs.
O 1374.	Gonda, Oudh	44
E 654.	Bamunpokri, Darjeeling Terai (Manson)	53
E 1257.	Tezpur, Assam (G. Mann)	47
E 2191.	Nowgong, Assam (Kurz)	46
E 4701.	Dibrugarh, Assam (H. C. Hill)	44
E 2467.	Calcutta (sapwood)	36

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18. APOROSA, Blume.

About 16 species, mostly either of Burma or Ceylon, there being 10 in the former and 5 in the latter. One species is found in the Nicobar Islands, *A. glabrifolia*, Kurz, common in dry grassy places. *A. Wallichii*, Hook. f.; Fl. Br. Ind. v. 350, is a large tree of the Khasia Hills, Sylhet, Chittagong and Tenasserim; and *A. aurea*, Hook. f.; Fl. Br. Ind. v. 351 (*A. microstachya*, Kurz For. Fl. ii. 363) is an evergreen tree of tropical forests in Chittagong and throughout Burma. *A. villosa*, Baill.; Fl. Br. Ind. v. 345; Kurz For. Fl. ii. 361; Vern. *Yamein*, *thitsat*, Burm., and *A. macrophylla*, Muell. Arg.; Fl. Br. Ind. v. 346; Kurz For. Fl. ii. 361; Vern. *Ingyin*, Burm., are deciduous trees common in the Burmese Eng forests. *A. acuminata*, Thw.; Fl. Br. Ind. v. 348; Bedd. Fl. Sylv. cxcix.; Trimen Fl. Ceyl. iv. 41, is a small tree of the forests of Tinnevelly and the moist region of Ceylon. *A. latifolia*, Thw.; Fl. Br. Ind. v. 347; Bedd. Fl. Sylv. cxcix.; Trimen Fl. Ceyl. iv. 39; Vern. *Maput*, *kebella*, *kampotta*, *kepiliya*, Cingh., is a moderate-sized tree of the Ceylon moist region with a hard durable wood. The remaining species are scarce only.

1. A. Roxburghii, Baill.; Fl. Br. Ind. v. 347; Kurz For. Fl. ii. 362; Gamble Darj. List 70. *Alnus dioica*, Roxb. Fl. Ind. iii. 580. Vern. *Kokra*, Beng.; *Kagbhulai*, Nep.; *Sanpalu*, *garokat*, Gáro; *Tauprengjan*, Magh; *Daukyat*, Burm.

An evergreen tree. *Bark* light brown, very thin, granular. *Wood* light red, moderately hard, even-grained. *Pores* small, scanty, radially disposed. *Medullary rays* fine to moderately broad and broad, numerous. Many medullary spots.

Eastern Lower Himalaya and sub-Himalayan tract; Assam, Khasia Hills and Eastern Bengal; Burma.

Sylhet—Kew Museum.

2. A. Lindleyana, Baill.; Fl. Br. Ind. v. 349; Bedd. Fl. Sylv. t. 286; Talbot

Bomb. List 181; Trimen Fl. Ceyl. iv. 40. Vern. *Sali, sulla, surroli*, Kan.; *Vittil*, Tam.; *Kodali*, Kader; *Kebella, barawa-embilla*, Cingh.

A much-branched evergreen tree. *Bark* brown, smooth. *Wood* brown, rough. *Pores* moderate-sized, rather scanty, in short radial strings between the fine, numerous, *medullary rays*.

Evergreen forests of the Western Ghâts from the Konkan southwards, rising to 4000 ft.; moist region of Ceylon.

Beddome says the wood is used for building and other purposes; Trimen that the fruit is eaten. Bourdillon gives W = 38 lbs., P = 515.

		lbs.
W 4550, 4591.	Travancore (Bourdillon)	45 and 38

No. 57, Ceylon Collection, new (Mendis), purports to be this, but the wood structure is quite different and unlike that of any Euphorbiaceous tree here described.

19. DAPHNIPHYLLUM, Blume.

Three species. *D. majus*, Muell. Arg.; Fl. Br. Ind. v. 353, is a small tree of Amherst in Burma.

1. **D. glaucescens**, Blume; Bedd. Fl. Sylv. ccxvii., t. 288 (under name *D. Roxburghii*, Baill.); Trimen Fl. Ceyl. iv. 42. Vern. *Nir-kocki, nir-chappay*, Badaga.

An evergreen small tree. *Bark* brown, somewhat corky, ⅛ in. thick, inner layers black. *Wood* grey, even-grained. *Pores* very small, numerous. *Medullary rays* fine, numerous, the distance between them equal to the transverse diameter of the pores.

Shola forests of the Nilgiri, Pulney and other S. Indian mountain ranges above 5000 ft.; hill forests of Ceylon.

A conspicuous tree in the Nilgiri sholas. The wood is used for fuel. Growth slow, 7 to 10 rings per inch of radius.

		lbs.
W 3732.	Coonoor, Nilgiris, 6000 ft. (Gamble)	39
W 3875.	Aramby, Ootacamund, 7000 ft. (Gamble)	41

2. **D. himalayense**, Muell. Arg.; Fl. Br. Ind. v. 354; Gamble Darj. List 70. Vern. *Ratendu*, Jaunsar; *Raktchandan, rakt anglia*, Kumaon; *Lal chandan*, Nep.

An evergreen tree. *Bark* brown, smooth. *Wood* greyish-brown with occasional streaks of bright crimson, soft but close- and even-grained; sapwood white. *Pores* very small, very numerous, evenly distributed, those of the crimson portion filled with red colouring matter. *Medullary rays* very fine, very numerous, causing a shining satiny silver-grain on a radial section, the distance between them equal to the transverse diameter of the pores.

Himalaya, from Simla eastwards, in valleys along streams at 4–6000 ft., risiu 10,000 ft. in Sikkim; Khasia Hills.

A most interesting wood, worthy of considerable attention, as the red-streaked parts are handsome, and look well in turnery and carvings. The red wood is powdered and used to make caste-marks by the hill people. The tree has much the appearance of a laurel when in leaf only, when in fruit of a *Symplocos*, especially *S. dryophila*, Clarke, which see, p. 466.

		lbs.
H 4414.	Deoban Forest, 7000 ft. (Gamble)	34
E 370.	Kalapokri, Darjeeling, 9000 ft. (Johnston)	45
E 2391.	Thosum La, Darjeeling, 8000 ft. (Gamble)	40

20. ANTIDESMA, Linn.

About 23 species, many of which, however, are more or less doubtful, and some very scarce. Besides the four whose wood is described and which are the most important and most common species, some 9 or 10 are of interest. *A. Roxburghii*, Wall.;

Fl. Br. Ind. v. 357 (*Stilago tomentosa*, Roxb. Fl. Ind. iii. 757) and *A. nigricans*, Tul. Fl. Br. Ind. v. 360, are small trees of Assam and Sylhet; while *A. khasianum*, Hook f.; Fl. Br. Ind. v. 362, is a small tree with whitish branches found in the Khasia Hills at 3–4000 ft. and the Duphla Hills in Assam. *A. velutinosum*, Bl.; Fl. Br. Ind. v. 356; Kurz For. Fl. ii. 359 and *A. velutinum*, Tul.; Fl. Br. Ind. v. 361; Kurz For Fl. ii. 359; Vern. *Kinbalin*, Burm., are evergreen small trees of the forests of Burma while *A. fruticulosum*, Kurz For. Fl. ii. 359; Fl. Br. Ind. v. 360, is a small branched shrub found in the tidal forests of Lower Pegu, on sandy soil.

A. Alexiteria, Linn.; Fl. Br. Ind. v. 359 (*A. zeylanicum*, Lamk.; Bedd. Fl. Sylv. cc.; Trimen Fl. Ceyl. iv. 44); Vern. *Hinembilla*, Cingh., is a much-branched small tree of South India and Ceylon. *A. Menasu*, Miq.; Fl. Br. Ind. v. 364; Talbot Bomb. List 182, is a common small tree of the forests of the Western Gháts in South India from the Konkan southwards, rising in the Nilgiris to 6000 ft.; and *A. pyrifolium*, Muell. Arg.; Fl. Br. Ind. v. 362; Bedd. Fl. Sylv. cc.; Trimen Fl. Ceyl. iv. 45, is a middle-sized tree common in the moist region of Ceylon up to 5000 ft.

Wood hard, usually red, smooth, apt to split and warp. *Pores* small, numerous. *Medullary rays* of two classes, very fine, and moderately broad.

1. **A. Ghæsembilla,** Gaertn.; Fl. Br. Ind. v. 357; Bedd. Fl. Sylv. cc.; Brandis For. Fl. 446; Kurz For. Fl. ii. 358; Talbot Bomb. List 182; Trimen Fl. Ceyl. iv. 43. *A. pubescens*, Willd. and *A. paniculatum*, Roxb. Fl. Ind. iii. 769, 770. Vern. *Khúdi jamb, limtoá*, Beng.; *Umtoá*, Hazaribagh; *Nuniári*, Uriya; *Mata suré*, Kól; *Pulsur, polari, jana-pa-laseru, pollai*, Tel.; *Jondri*, Mar.; *Pyizin*, Burm.; *Buembilla*, Cingh.

A small deciduous tree. *Bark* grey or pale brown, $\frac{1}{6}$ in. thick, with a few deciduous scales. *Wood* red, with darker-coloured heartwood, smooth, hard, close- and even-grained. *Annual rings* indistinctly marked by concentric lines. *Pores* small and moderate-sized, uniformly distributed. *Medullary rays* of two sizes, few moderately broad rays with numerous fine rays between them, prominent in the silver-grain.

Sub-Himalayan tract from the Sutlej eastwards; Central, Southern and Western India; tidal, Eng and savannah forests of Burma; moist region of Ceylon.

The leaves and fruit are eaten.

		lbs.
C 1161.	Ahiri Reserve, Central Provinces (R. Thompson)	46
B 2246.	Andaman Islands (Col. Ford, 1866).	52

2. **A. Bunius,** Spr.; Fl. Br. Ind. v. 358; Bedd. Fl. Sylv. cc.; Kurz For. Fl. ii. 358; Gamble Darj. List 70; Talbot Bomb. List 182; Trimen Fl. Ceyl. iv. 43. *Stilago Bunius*, Linn.; Roxb. Fl. Ind. iii. 758. Vern. *Himalcheri*, Nep.; *Kantjer*, Lepcha; *Amati*, Mar.; *Karawala-kebella*, Cingh.

A small tree. *Bark* greyish-brown. *Wood* red, hard, in appearance similar to that of *A. Ghæsembilla*.

Lower Himalaya and sub-Himalayan tract from Nepal eastwards up to 3000 ft.; Parásnáth Hill in Behar; Western Gháts from the Konkan southwards; Upper Tenasserim; moist region of Ceylon.

The leaves and fruit are eaten.

		lbs.
E 2430.	Chenga Forest, Darjeeling Terai (Gamble)	46

3. **A. diandrum,** Roth; Fl. Br. Ind. v. 361; Bedd. Fl. Sylv. cci.; Brandis For. Fl. 447; Kurz For. Fl. ii. 360; Gamble Darj. List 70; Talbot Bomb. List 182; Trimen Fl. Ceyl. iv. 44. *Stilago diandra*, Roxb. Fl. Ind. iii. 759. Vern. *Amtu*, Kashmir; *Káli-khatai*, Dehra Dún; *Amli, amári, sarshoti, gúr mussureya, ban mussureya, dhakki*, Hind.; *Mutta*, Beng.; *Patimil*, Nep.; *Kantjer*, Lepcha; *Nuniári, nuninunika*, Uriya; *Mata-ara*, Sonthal; *'Amtua sag*, Mal Pahari; *Pellagumudu*, Tel.; *Masúr bauri*, Gondi; *Kinbalin*, Burm.

A small deciduous tree. *Bark* smooth, grey, inner bark pale red,

fibrous. *Wood* pinkish-grey, hard, close-grained. *Pores* small and very small, uniformly distributed. *Medullary rays* of two sizes, moderately broad and very fine, wavy. *Annual rings* marked by a fine line.

Sub-Himalayan tract from the Jumna eastwards; Central, Western and Southern India; mixed forests all over Burma; moist region of Ceylon.

A common bush or small tree in the mixed forests, also in Sál forests and savannahs. The bright green leaves, which turn red before falling, are pleasantly acid and edible, as are the fruits.

		lbs.
O 1368.	Gonda, Oudh (Wood)	42
O 1464.	Bahraich, Oudh	40

4. A. acuminatum, Wall.; Fl. Br. Ind. v. 363; Gamble Darj. List 70. Vern. *Kumbyúng, tungcher,* Lepcha.

A small tree. *Bark* thin, brown. *Wood* red, in structure similar to that of *A. Ghæsembilla,* but with smaller *pores* and finer *medullary rays.*

Sikkim Himalaya up to 2000 ft.; Assam, Khasia Hills and Sylhet, ascending to 4000 ft.

Found in ravines and valleys. Fruit edible.

		lbs.
E 2431.	Chenga Forest, Darjeeling Terai (Gamble)	52

21. BACCAUREA, Lour.

Evergreen, usually diœcious trees, four species. *B. parviflora,* Muell. Arg.; Fl. Br. Ind. v. 368; Kurz For. Fl. ii. 357, is a small tree of Tenasserim with an acid edible fruit; and *B. flaccida,* Muell. Arg.; Fl. Br. Ind. v. 370, is also found in Burma.

1. B. courtallensis, Muell. Arg.; Fl. Br. Ind. v. 367; Talbot Bomb. List 182. *B. sapida,* Bedd. Fl. Sylv. t. 280. Vern. *Koli kuki,* Kan.; *Mútta thúri, mútti keipu,* Mal.

A moderate-sized tree. *Wood* white, moderately hard. *Pores* small, scanty, often in radial strings. *Medullary rays* moderately broad, numerous, showing a neat silver-grain.

Forests of the Western Ghâts from N. Kanara to Travancore, up to 3000 ft.

The fruit is edible, being pleasantly acid; "it generally hangs in great profusion from the trunks, the whole trunk appearing as a crimson mass" (Bedd.). Bourdillon gives W = 42 lbs., P = 569.

		lbs.
W 4629.	Travancore (Bourdillon)	40

2. B. sapida, Muell. Arg.: Fl. Br. Ind. v. 371; Kurz For. Fl. ii. 356; Gamble Darj. List 70. *Pierardia sapida,* Roxb. Fl. Ind. ii. 254. Vern. *Lutco,* Hind.; *Kala bogoti,* Nep.; *Sumbling,* Lepcha; *Latecku,* Ass.; *Kanaizu,* Magh; *Kanazo,* Burm.

A moderate-sized evergreen tree. *Bark* thin, grey, corky. *Wood* greyish-brown, soft, with transverse lines of loose tissue very numerous. *Pores* small, in short radial lines. *Medullary rays* moderately broad to broad, the distance between the rays being from one to three times the transverse diameter of the pores.

Sub-Himalayan tract and lower hills of the Eastern Himalaya; Assam and Sylhet; tropical forests and moister hill forests of Chittagong and Burma; Andaman Islands: often cultivated.

This species has a yellow fruit, which is found growing in clusters on the trunk or branches and is eaten, being acid and pleasant, and called "*Lutqua.*" The leaves are used in Sikkim and Assam in dyeing. Brandis, in Burma List of 1862, No. 97, gives W = 61 lbs.; Wallich, No. 154, gives 38 lbs. for the wood; the specimens examined average 42 lbs.

		lbs.
E 1265.	Tezpur, Assam (G. Mann)	42
B 2552.	Burma (Brandis, 1862)	44
B 3145♂, 3146♀,	Magayee, Burma	42 and 43
B 2686, 2720.	Tavoy (Wallich, 1828)	41

22. HYMENOCARDIA, Wall.; *H. punctata*, Wall.; Fl. Br. Ind. v. 377 (*H. Wallichii*, Tul.; Kurz For. Fl. ii. 394); Vern. *Yegin*, *yegyin*, Burm., is a deciduous shrub or small tree, common in the swamp forests and along streams in Burma, and having a rather heavy brown or reddish-brown close-grained wood.

Tribe IV. GALEARIEÆ.

23. GALEARIA, Zoll. and Moritz. Two species. *G. Helferi*, Hook. f.; Fl. Br. Ind. v. 378 (*G. Wallichii*, Kurz For. Fl. ii. 407), is an evergreen small tree or large shrub of tropical forests in Burma. *G. Wallichii*, Br.; Fl. Br. Ind. v. 379, is a tree of Tavoy.

24. MICRODESMIS, Planch. *M. caseariæfolia*, Planch.; Fl. Br. Ind. v. 380; Kurz For. Fl. ii. 408, is an evergreen small tree of Tenasserim.

25. PLATYSTIGMA, Br. *P. myristiceum*, Br.; Fl. Br. Ind. v. 381, is a little-known shrub or tree of Sylhet.

Tribe V. CROTONEÆ.

26. JATROPHA, Linn.

Four indigenous and three introduced species of more or less succulent soft-wooded shrubs. *J. glandulifera*, Roxb. Fl. Ind. iii. 688; Fl. Br. Ind. v. 382; Kurz For. Fl. ii. 403; Talbot Bomb. List 183; Trimen Fl. Ceyl. iv. 45; Vern. *Jangli-erandi*, Mar., is a glaucous-looking small shrub of the Bombay coast near Karwar and of the black cotton soil lands of the Deccan. *J. nana*, Dalz. and Gibs.; Fl. Br. Ind. v. 382; Talbot Bomb. List 183; Vern. *Kirkundi*, Mar., is a small dwarf shrub with 3-lobed leaves found in dry stony lands of the N. Deccan about Poona. *J. heterophylla*, Heyne; Fl. Br. Ind. v. 382, is a somewhat similar plant of dry stony lands in the Deccan and Circars. *J. Wightiana*, Muell. Arg.; Fl. Br. Ind. v. 383, is a shrub of stony lands in Coimbatore resembling *J. Curcas*, but with peltate leaves.

Wood white, soft, corky in texture. *Pores* small to moderate-sized, often subdivided, very scanty. *Medullary rays* fine, very numerous.

1. **J. gossypifolia**, Linn.; Fl. Br. Ind. v. 383; Trimen Fl. Ceyl. iv. 46. Vern. *Addalay*, *atalai*, Tam.; *Nela-amida*, Tel.

A shrub with thick stem. *Bark* shining, rough with raised small black patches. *Wood* very soft, corky in texture, white. *Pores* small, often subdivided, in scanty groups. *Medullary rays* extremely fine, very numerous.

Native of South America; now common in many parts of India, especially near the coast, very common in Madras.

The seeds give an oil which is used in native medicine.

C 3837. Goluntra, Ganjam (Gamble).

2. **J. multifida**, Linn.; Fl. Br. Ind. v. 383; Talbot Bomb. List 183. The Coral Plant. Vern. *Chinni-erandi*, Mar.

A tree-like shrub. *Bark* light brown, shining. *Wood* white or greyish-white, soft, corky in texture. *Pores* moderate-sized, usually subdivided, very scanty. *Medullary rays* extremely fine, very numerous.

Native of South America. Introduced and cultivated in Indian gardens.

The seeds are somewhat poisonous, purgative and emetic.

		lbs.
O 4925.	Dehra Dún (Gamble)	28

3. **J. Curcas**, Linn.; Fl. Br. Ind. v. 383; Roxb. Fl. Ind. iii. 686; Brandis For. Fl. 442; Kurz For. Fl. ii. 403; Gamble Darj. List 71; Talbot Bomb. List 183; Trimen Fl. Ceyl. iv. 46. The Physic Nut. Vern. *Bagberenda, safed arand*, Hind., Beng.; *Kadam*, Nep.; *Verenda*, Sonthal; *Kulejera, totka bendi*, Kól; *Gulancha*, Ass.; *Irundi, jaiphal*, Mar.; *Kaat-amunak*, Tam.; *Nepalam*, Tel.; *Maranarulle, maraharalu*, Kan.; *Kaak-avenako*, Mal.; *Thinbau-kyetsu*, Burm.

A soft-wooded evergreen shrub. *Bark* greenish-white, smooth, peeling off in thin flakes. *Wood* white, very soft. *Pores* moderate-sized, scanty; usually subdivided. *Medullary rays* extremely fine, very numerous.

Indigenous in America, cultivated in most parts of India.

This plant is much used for hedges and planted near villages. It is grown from cuttings, which strike very easily. The juice of the leaves forms a lather like soap. The seeds give an oil incorrectly known as "Croton Oil," which is used for burning, in medicine as a purgative and emetic, and as an application in cutaneous diseases. In the Madras Presidency the fruit is sometimes collected in the forests as a "minor forest product" and sold. The leaves are sometimes used to feed the "*Eri*" silkworm in Assam, when, in later stages, castor oil or *Heteropanax* leaves are not available (Stack).

		lbs.
E 2427.	Manjha, Darjeeling Terai (Gamble)	25
O 4572.	Dehra Dún (Gamble)	20

27. TRITAXIS, Baill. *T. Beddomei*, Benth.; Fl. Br. Ind. v. 384, is a tree of the forests at the foot of the Tinnevelly Gháts.

28. ALEURITES, Forst. *A. moluccana*, Willd.; Fl. Br. Ind. v. 384; Bedd. Fl. Sylv. t. 276; Kurz For. Fl. ii. 377; Talbot Bomb. List 183; Trimen Fl. Ceyl. 46 (*A. triloba*, Forst.; Roxb. Fl. Ind. iii. 629); the "Belgaum Walnut;" Vern. *Akrod, jaiphal*, Mar.; *Rata-kékuna, tel-kékuna*, Cingh., is a handsome tree indigenous in the Malay Archipelago, whence it has been introduced into India. It is now found wild in the Wynaad and in Ceylon, and is often cultivated. As an ornamental tree, its cultivation is, as Beddome suggests, to be recommended; and it has the further advantage of bearing nuts called "Candle-nuts," from the edible kernels of which a useful oil can be expressed and used for illumination and as a drying oil for paint, for which purpose it has been said to equal linseed oil. The wood is not well known: in M. Sébert's "Notice sur les bois de la Nouvelle Calédonie" the wood of the *Bancoulier* is said to be white, soft, light and of bad quality, with an average weight of 38 lbs. per cubic foot. *A. cordata*, Muell. Arg.; Fl. Br. Ind. v. 384, is a handsome small tree with large flowers, occasionally seen in Indian gardens.

29. CROTON, Linn.

About 24 species, trees, shrubs or climbers, chiefly Burmese, with a few South Indian or of the Eastern Himalaya, none extending to the North-West, beyond Oudh. Several of the species are small, scarce and of small importance. *C. Joufra*, Roxb. Fl. Ind. iii. 685; Fl. Br. Ind. v. 387; Kurz For. Fl. ii. 373; Vern. *Joufra*, Beng., is a tree of Assam, Eastern Bengal and Burma; and *C. lævifolius*, Blume; Fl. Br. Ind. v. 391, is a small tree of the Khasia Hills, up to 4000 ft. In Burma, besides those specially described, *C. robustus*, Kurz For. Fl. ii. 372; Fl. Br. Ind. v. 387, is a small evergreen tree; *C. Wallichii*, Muell. Arg.; Fl. Br. Ind. v. 390; Kurz For. Fl. ii. 373, is a deciduous tree of the tropical forests; and *C. flocculosus*, Kurz For. Fl. ii. 375; Fl. Br. Ind. v. 394, is a tree of the swamp forests of the Irrawaddy delta. *C. sublyratus*, Kurz For. Fl. ii. 374; Fl. Br. Ind. v. 390, is a deciduous shrub of the coast forests of the Andaman Islands.

C. malabaricus, Bedd. Fl. Sylv. cciv.; Fl. Br. Ind. v. 386, is a small tree of the evergreen forests of the Western Gháts up to 4000 ft., with silvery foliage, such as also possesses the shrubby *C. reticulatus*, Heyne; Fl. Br. Ind. v. 386; Bedd. Fl. Sylv. cciv.; Talbot Bomb. List 184; Vern. *Panduray*, Mar., which occurs in the same region, but extends north to the Konkan. *C. Gibsonianus*, Nimmo, is a shrub of the evergreen

forests on the Ghâts of N. Kanára, common near the falls of Gairsoppa; and *C. Klotzschianus*, Wight is a shrub or small tree of the dry evergreen forests of the Deccan, common at Ballipalle in Cuddapah and extending to Ceylon. *C. aromaticus*, Linn.; Fl. Br. Ind. v. 388; Bedd. Fl. Sylv. cciv.; Talbot Bomb. List 184; Trimen Fl. Ceyl. iv. 47; Vern. *Wel-keppetiya, keppetiya*, Cingh.; *Teppaddi*, Tam., is an aromatic shrub or small tree of the forests of the western side of South India from the Konkan southwards, especially common on the Bababuden hills of Mysore, in the Wynaad, and on the Nilgiri slopes, where it rises to about 5000 ft. It also is common in Ceylon.

C. Tiglium, Linn.; Fl. Br. Ind. v. 393; Roxb. Fl. Ind. iii. 682; Kurz For. Fl. ii. 374; Brandis For. Fl. 440; Talbot Bomb. List 184; Vern. *Jaipál, jamal gota*, Hind.; *Kanako*, Burm., is the "Purging Croton," the plant which gives the real Croton oil of medicine, used as a powerful purgative. It is not indigenous in India, but is said to be naturalized or cultivated almost throughout the country. I have, however, only seen it once or twice, and then in gardens. The garden "Crotons" with variegated leaves belong to the genus *Codiæum*.

Wood white, usually hard, close-grained. *Pores* moderately large to large, scanty, often subdivided. *Medullary rays* very fine, very numerous. Transverse bars joining the rays generally found.

1. **C. argyratus**, Bl.; Fl. Br. Ind. v. 385; Kurz For. Fl. ii. 372. Vern. *Chonoo*, Burm.; *Talibdá*, And.

A moderate-sized or small evergreen tree. *Bark* thin, grey. *Wood* hard, cream-coloured, close- and even-grained, seasons well. *Pores* large and very large, scanty, circular, very prominent on a vertical section. *Medullary rays* extremely fine, very numerous. Minute transverse bars crossing the cellular tissue between the rays.

Martaban, Tenasserim and the Andaman Islands.

This is a fine wood, well worthy of notice. It is curious that neither by Kurz nor in the Fl. Br. Ind. is this tree given as growing in the Andaman Islands. There seems to be, however, no reason to doubt its identification.

		lbs.
B 501, 515.	Andaman Islands (General Barwell) . . .	48 and 46
	Nordlinger's Sections, vol. 10 (Tab. XII. 6).	

2. **C. scabiosus**, Bedd. Fl. Sylv. t. 283; Fl. Br. Ind. v. 386. Vern. *Yerri chilla*, Tel.

A small tree, often gregarious. *Bark* ¼ in. thick, dark brown, very rough with many fissures and granulations. *Wood* hard, yellowish-white, close-grained. *Pores* small, in radial strings. *Medullary rays* very fine, very numerous. Transverse bars faint.

Hills of South Deccan, especially on the Palkonda Hills in Cuddapah and the Nallamalai Hills in Kurnool, at 2–4000 ft.; also in Travancore.

A pretty and interesting tree, with silvery foliage. It usually occurs on transition rocks.

D 3868. Palkonda Hills, Cuddapah, 2500 ft. (Gamble).

3. **C. oblongifolius**, Roxb. Fl. Ind. iii. 685; Fl. Br. Ind. v. 386; Bedd. Fl. Sylv. cciv.; Brandis For. Fl. 440; Kurz For. Fl. ii. 373; Gamble Darj. List 71; Talbot Bomb. List 184; Trimen Fl. Ceyl. iv. 47. Vern. *Arjunna*, Oudh; *Akh*, Nep.; *Burma, parokupi*, Ass.; *Puter*, Monghyr; *Goté*, Sonthal; *Koté, putol*, Mal Pahari; *Maisonda*, Koderma; *Kurti, konya, kuli*, Kól; *Putila*, Bhumij; *Putri*, Kharwar; *Gunsur*, Mar.; *Bhutankusam*, Tel.; *Millakunari*, Tam.; *Thityin*, Burm.

A small deciduous, often gregarious tree. *Bark* 1 in. thick, grey or brownish, inner bark red, coarsely fibrous. *Wood* yellowish-white, moderately hard. *Pores* moderate-sized, often subdivided or in groups

of 3 to 4, scanty. *Medullary rays* fine and very fine, very numerous. Wavy concentric bands of loose pale tissue.

Sub-Himalayan tract from Oudh and Gorakhpur eastwards; Bengal, Behar, the Sonthal Parganas, Chota Nagpore and the Circars; rare in the Konkan; upper mixed forests of Burma up to 2000 ft.; dry region of Ceylon.

A very common plant in the forests of Oudh, Behar, Bengal and Chota Nagpore especially, often occurring in patches almost pure, and remarkable for the brilliant red colour of the leaves before falling. The bark, leaves and fruit are used in native medicine. It is frequently planted for ornament.

C 3458. Chandwa, Tori, Chota Nagpore (Gamble).
B 3201. Burma (Brandis, 1862).

4. **C. caudatus,** Geisel; Fl. Br. Ind. v. 388; Kurz For. Fl. ii. 375; Gamble Darj. List 71; Trimen Fl. Ceyl. iv. 48. *C. drupaceus*, Roxb. Fl. Ind. iii. 683. Vern. *Nan bhantwi*, Beng.; *Takchabrik*, Lepcha; *Wústa*, Uriya.

A large straggling shrub. *Bark* thin, grey. *Wood* white or yellowish-white, hard, close-grained. *Pores* large, scanty, sometimes subdivided, prominent on a vertical section. *Medullary rays* very fine to extremely fine, very numerous. Numerous wavy bars of loose tissue interrupting the rays.

Lower Himalaya and sub-Himalayan tract up to 4000 ft. from Nepal eastwards; Bengal, Assam, Burma and South India, chiefly on the banks of streams; dry region of Ceylon.

Home says the wood is used for fuel and the leaves applied as poultices to sprains. In Orissa, the branches are used to tie rafters; in the Sundarbans for firewood.

E 3298. Sivoke, Darjeeling Terai (Gamble).

30. GIVOTIA, Griff.

1. **G. rottleriformis,** Griff.; Fl. Br. Ind. v. 395; Bedd. Fl. Sylv. t. 285; Brandis For. Fl. 442; Talbot Bomb. List 185; Trimen Fl. Ceyl. 50. Vern. *Vendale, butalli, bulali*, Tam.; *Tella púnki, tella puliki, petiri puliki*, Tel.

A moderate-sized tree. *Bark* brown, smooth, ½ in. thick, peeling off in circular thick bosses, leaving pits. *Wood* white, exceedingly light, very soft but even-grained. *Pores* moderate-sized to large, very scanty, very prominent on a vertical section, often many times subdivided; annual rings marked by a dark line. *Medullary rays* numerous, uniform, fine, the distance between the rays much less than the transverse diameter of the pores. Occasional faint light bars joining the rays.

Dry districts of the Deccan, Mysore and Carnatic; dry region of Ceylon.

A conspicuous tree on account of its large leaves, densely white—woolly beneath. Growth fast, 2 to 6 rings per inch, but the annual rings are perhaps doubtful. The wood is used for carved figures, for toys, imitation fruit and other fancy articles, which are lacquered and painted; in Mysore for theatrical masks; also for catamarans. The seeds give an oil which is valuable for lubricating fine machinery.

		lbs.
D 3152.	Cuddapah (Beddome)	14
D 4141.	Bellary (Gamble)	20

31. TRIGONOSTEMON, Blume. Six species, evergreen trees or shrubs. *T. semperflorens*, Muell. Arg.; Fl. Br. Ind. v. 397 (*Cluytia semperflorens*, Roxb. Fl. Ind. iii. 740), is a small shrub of Assam, Sylhet and Cachar. *T. longifolius*, Baill., *T. heteranthus*, Wight, and *T. lætus*, Baill.; Fl. Br. Ind. v. 396–7; Kurz For. Fl. ii. 406–7, are small trees or shrubs of Tenasserim. *T. nemoralis*, Thw.; Fl. Br. Ind. v. 398; Bedd. Fl. Sylv. ccxiii.; Trimen Fl. Ceyl. iv. 58, is a slender shrub or small tree of the hills of Tinnevelly, up to 3000 ft., and of Ceylon, where also is found, but rare, *T. diplopetalus*, Thw.; Trimen Fl. Ceyl. iv. 51, t. 83.

32. OSTODES, Blume.

Three species. *O. zeylanica*, Muell. Arg.; Fl. Br. Ind. v. 400; Bedd. Fl. Sylv. t. 274; Trimen Fl. Ceyl. iv. 52; Vern. *Sotege*, Kan.; *Walkekuna, olupetta*, Cingh., is a large tree of the forests of the Wynaad, Anamalai, Pulney and Travancore Hills, up to 5000 ft., and the moist region of Ceylon up to 4000 ft. *O. Helferi*, Muell. Arg.; Fl. Br. Ind. v. 401; Kurz For. Fl. ii. 404, is a tree of Upper Tenasserim, found in the plains round Moulmein.

1. O. paniculata, Bl.; Fl. Br. Ind. v. 400; Kurz For. Fl. ii. 404; Gamble Darj. List 71. Vern. *Bepari, mya*, Nep.; *Palok*, Lepcha.

A large evergreen tree. *Bark* light grey. *Wood* white, soft. *Pores* scanty, small to large, subdivided. *Medullary rays* very fine, uniform, closely packed.

Forests of the Sikkim Himalaya at 2–6000 ft., Khasia Hills; Sylhet; Hills of Martaban.

A handsome tree. Growth moderate, 8 to 9 rings per inch of radius. It gives a gum which is used as size in the manufacture of paper.

		lbs.
E 3110.	Darjeeling, 6000 ft. (Gamble)	26

33. BLACHIA, Baill. Five species, shrubs or small trees. *B. umbellata*, Baill.; Fl. Br. Ind. v. 402; Trimen Fl. Ceyl. iv. 53 (*Codiæum umbellatum*, Muell. Arg.; Bedd. Fl. Sylv. ccxiii.); Vern. *Kosatta*, Cingh., is a shrub or small tree of Travancore and the moist region of Ceylon. *B. reflexa*, Benth. and *B. calycina*, Benth. are shrubs of the Nilgiris, the latter extending to Travancore. *B. denudata*, Benth.; Fl. Br. Ind. v. 403; Talbot Bomb. List, 185, is a small tree of the evergreen forests of the Konkan and N. Kanara, common on the Supa Ghát. *B. andamanica*, Hook. f.; Fl. Br. Ind. v. 403 (*Codiæum andamanicum*, Kurz For. Fl. ii. 405), is an evergreen large shrub, common in the tropical forests of the Andaman Islands.

34. DIMORPHOCALYX, Thw.

Two species. *D. glabellus*, Thw.; Fl. Br. Ind. v. 403; Trimen Fl. Ceyl. iv. 54, t. 84; Vern. *Tentukki*, Tam.; *Weliwenna*, Cingh., is a small much-branched tree of South India and the dry region of Ceylon.

1. D. Lawianus, Hook. f.; Fl. Br. Ind. v. 404; Talbot Bomb. List 185. *Trigonostemon Lawianus*, Muell. Arg.; Bedd. Fl. Sylv. t. 273.

A tree. *Wood* white, hard, close-grained. *Pores* small, very scanty. *Medullary rays* extremely fine, numerous. Numerous very fine pale bars in the tissue between the rays.

Western Ghâts from the Konkan southwards, up to 4000 ft. on the Anamalai Hills.

		lbs.
W 4714.	Travancore (Bourdillon).	59

35. AGROSTISTACHYS, Dalz.

Three species, shrubs or small trees. *A. indica*, Dalz.; Fl. Br. Ind. v. 406; Bedd. Fl. Sylv. ccv.; Talbot Bomb. List 186; Trimen Fl. Ceyl. iv. 55, is a shrub of the banks of streams in the Western Ghâts from the Konkan southwards and of the low country of Ceylon. *A. Hookeri*, Benth.; Fl. Br. Ind. v. 406; Trimen Fl. Ceyl. iv. 55 (*Sarcoclinium Hookeri*, Thw.; Bedd. Fl. Sylv. ccvi.); Vern. *Maha-beru, duja-beru*, Cingh., is a small-sized tree of the moist region of Ceylon.

1. A. longifolia, Benth.; Fl. Br. Ind. v. 407; Kurz For. Fl. ii. 377; Talbot Bomb. List 186; Trimen Fl. Ceyl. iv. 56. *Sarcoclinium longifolium*, Wight; Bedd. Fl. Sylv. ccv. Vern. *Manchárei*, Tam.; *Mulimpalei*, Trav. Hills; *Beru*, Cingh.

A small tree. *Wood* light brown, moderately hard. *Pores* small

in radial strings between the fine and very numerous indistinct *medullary rays.*

Evergreen forests of the Western Gháts from N. Kanara southwards along streams and up to 4000 ft.; hill forests of Ceylon at 3–6000 ft.; Tenasserim or the Andamans.

The stiff large hard leaves are used in Ceylon for roofing huts, like shingles, and are durable (Trimen).

		lbs.
W 4551.	Travancore (Bourdillon)	38

36. SUMBAVIA, Baill. *S. macrophylla*, Muell. Arg.; Fl. Br. Ind. v. 408; Kurz For. Fl. ii. 376, is an evergreen tree common along streams in Burma.

37. CLAOXYLON, A. Juss. Three species, shrubs or small trees. *C. indicum*, Hassk.; Fl. Br. Ind. v. 410, is a large shrub or small tree of S. India and Burma, apparently scarce. *C. khasianum*, Hook f. is a shrub of Assam, the Khasia Hills, Cachar and Sylhet; and *C. oligandrum*, Muell. Arg., a rare shrub of Ceylon. There are also 3 shrubby little-known species in Travancore.

38. ACALYPHA, Linn. *A. fruticosa*, Forsk.; Fl. Br. Ind. v. 415; Kurz For. Fl. ii. 397 (*A. amentacea*, Roxb. Fl. Ind. iii. 676), is a strong-smelling deciduous shrub of South India, Burma and Ceylon.

39. ADENOCHLÆNA, Baill. Three species. *A. indica*, Bedd.; Fl. Br. Ind. v. 418; Talbot Bomb. List 186 (*Cephalocroton indicum*, Bedd. Fl. Sylv. t. 261), is a large tree of the banks of streams in the Western Gháts from N. Kanara southwards, up to 4000 ft. *A. silhetiana*, Benth. is a shrub of the Khasia Hills; and *A. zeylanica*, Thw.; Trimen Fl. Ceyl. iv. 60, t. 85, is a shrub of the hills of Ceylon.

40. CŒLODEPAS, Hassk. *C. calycinum*, Bedd. Fl. Sylv. ccvii. t. 320; Fl. Br. Ind. v. 419, is a tree of the hills of Tinnevelly. Vern. *Katpira.*

41. ALCHORNEA, Swartz. Two species. *A. mollis*, Muell. Arg.; Fl. Br. Ind. iv. 420 (*Sapium cordifolium*, Roxb. Fl. Ind. iii. 693), is a small tree of the Central and Eastern Himalaya, Assam and the hills of the N. Circars. *A. tiliæfolia*, Muell. Arg.; Fl. Br. Ind. v. 421; Fl. Br. Ind. v. 421; Kurz For Fl. ii. 386; Gamble Darj. List 71; Vern. *Chota Kagshi*, Nep., is an evergreen shrub of the lower Darjeeling Hills up to 5000 ft., Assam, the Khasia Hills, Sylhet and Tenasserim (or Andaman Islands), found in the undergrowth of evergreen forest.

42. PODADENIA, Thw. *P. sapida*, Thw.; Fl. Br. Ind. v. 423; Trimen Fl. Ceyl. iv. 62 (*Rottlera Thwaitesii*, Baill.; Bedd. Fl. Sylv. t. 282), is a large endemic scarce tree in Ceylon, found in the moist region.

43. TREWIA, Linn.

Two species. *T. polycarpa*, Benth.; Fl. Br. Ind. v. 424; Talbot Bomb. List 186 (*T. nudiflora*, Bedd. Fl. Sylv. t. 281, *non* Linn.), is a tree of the Konkan and N. Kanara differing from the true *T. nudiflora* chiefly by having small fruit.

1. T. nudiflora, Linn.; Fl. Br. Ind. v. 423; Roxb. Fl. Ind. iii. 837; Brandis For. Fl. 443; Kurz For. Fl. ii. 379; Gamble Darj. List 71; Talbot Bomb. List 186; Trimen Fl. Ceyl. iv. 61. Vern. *Túmri*, *khamára*, Kumaon; *Bhillaur*, *bhillaura*, Oudh; *Pitali*, Beng.; *Garum*, *gamari*, *kurong*, Nep.; *Tungflam*, Lepcha; *Gara lohadáru*, Kól; *Gamhár*, Monghyr; *Monda*, Uriya; *Pitari*, Mar.; *Kat kumbla*, Kan.; *Hruprukban*, Magh; *Pambara kumbil*, Mal.; *Yehmyôk*, Burm.

A deciduous diœcious tree. *Bark* smooth, grey. *Wood* white, soft, not durable. *Pores* moderate-sized, subdivided and often elongated, the transverse diameter several times greater than the distance between the closely packed uniform, fine *medullary rays.* Fine, ladder-like, straight or oblique bars crossing the tissue between the rays.

Sub-Himalayan tract from the Jumna eastwards to Assam, up to 3000 ft.; Central, Western and Southern India; tropical forests of Chittagong and Burma; scarce in Ceylon.

This tree resembles, as several of its vernacular names indicate, the *Gmelina arborea*, but the foliage is not so grey, and the leaves are more cordate. The flowers, of course, at once distinguish it. It chiefly occurs in swampy places and along streams, and fruits in great profusion. The wood is a good one for purposes for which a soft wood is required, but, like most of the soft white woods, it has to be cut up when green and seasoned in dry air if it is to retain its white colour and not get discoloured of a muddy grey. It is used for drums, and, according to Brandis, for agricultural implements.

		lbs.
E 2468.	Calcutta (King)	29
B 311.	Burma, 1867	28

44. COCCOCERAS, Miq. *C. plicatum*, Muell. Arg.; Fl. Br. Ind. v. 424 (*Hymenocardia plicata*, Kurz For. Fl. ii. 395); Vern. *Yegyin*, Burm., is a deciduous tree of the swamp and savannah forests of Burma. Kurz gives W = 35 lbs., breaking weight 153 to 170 lbs.

45. CŒLODISCUS, Baill. Four species, all small shrubs, the largest and most important of which seems to be *C. glabriusculus*, Kurz For. Fl. ii. 393; Fl. Br. Ind. v. 426, which is common in the upper mixed forests of Burma, especially along streams.

46. MALLOTUS, Lour.

This genus as described in Fl. Br. Ind. contains two subgenera. 1. BLUMEODENDRON with one species: *M. Kurzii*, Hook. f.; Fl. Br. Ind. v. 427 (*Blumeodendron Tokbrai*, Kurz For. Fl. ii. 391), an evergreen tree of the Andaman Islands with broad thick leaves; and 2. EUMALLOTUS with 29 species, most of which are scarce shrubs or small trees of evergreen forests, but little known. Outside the species whose wood has been described, the most common one is *M. repandus*, Muell. Arg.; Fl. Br. Ind. v. 442; Bedd. Fl. Sylv. ccx.; Brandis For. Fl. 444; Kurz For. Fl. 380; Talbot Bomb. List 187; Trimen Fl. Ceyl. iv. 67 (*Rottlera dicocca*, Roxb. Fl. Ind. iii. 829); Vern. *Akús*, Hind.; *Kanda-veltu*, Tel.; *Ngahlaingbo*, Burm., which is a large straggling or scandent shrub very common in waste places and hedges as well as in the forests in the Peninsula and in Assam, Eastern Bengal, Burma and Ceylon. *M. khasianus*, Hook. f.; Fl. Br. Ind. v. 438, is a small tree of the Khasia Hills.

In Burma, the chief species are: *M. cochinchinensis*, Lour.; Fl. Br. Ind. v. 430 (*M. paniculatus*, Muell. Arg.; Kurz For. Fl. ii. 383), an evergreen tree with whitish leaves, not uncommon along streams in the forests of Burma; *M. acuminatus*, Muell. Arg.; Fl. Br. Ind. v. 431; Kurz For. Fl. ii. 383, an evergreen tree of Tenasserim and the Andaman Islands; and *M. floribundus*, Muell. Arg.; Fl. Br. Ind. v. 432, also a tree of Tenasserim.

M. stenanthus, Muell. Arg.; Fl. Br. Ind. v. 437; Bedd. Fl. Sylv. ccix.; Talbot Bomb. List 187, is a small tree of the evergreen forests of N. Kanara; and *M. Lawii*, Muell. Arg. is a small tree of the same forests, extending, however, north to the Konkan and south to Malabar. *M. muricatus*, Bedd.; *M. Beddomei*, Hook. f. and *M. atrovirens*, Muell. Arg. are all small trees of the Western Ghâts in South India, where also is found *M. rhamnifolius*, Muell. Arg.; Fl. Br. Ind. v. 440; Trimen Fl. Sylv. iv. 66 (*M. micranthus*, Muell. Arg. and *M. zeylanicus*, Muell. Arg.; Bedd. Fl. Sylv. ccix.); Vern. *Marai-tium*, Tam., a small tree which extends to the low country of Ceylon, where it is common. *M. Walkeræ*, Hook. f. is also a common small tree in Ceylon.

Pores small, in radial lines. *Medullary rays* fine, uniform, closely packed. In some species numerous faint transverse bars.

1. **M. Roxburghianus**, Muell. Arg.; Fl. Br. Ind. v. 428; Kurz For. Fl. ii. 383; Gamble Darj. List 71. *Rottlera peltata*, Roxb. Fl. Ind. iii. 828. Vern. *Kamli mallata, phusri mallata*, Nep.; *Nim pooteli*, Beng.; *Sirgúllum*, Sylhet.

A small evergreen tree. *Wood* white, moderately hard, close-grained. *Pores* small, often in radial lines, uniformly distributed. *Medullary rays* uniform, fine, very numerous, equidistant. Faint transverse bars.

Eastern Himalaya from Sikkim eastwards and up to 3000 ft., in undergrowth of damp forests; Assam, the Khasia Hills, Sylhet, Chittagong and Martaban.

E 2423. Chenga Forest, Darjeeling Terai (Gamble) . . . . . lbs. 46

2. **M. nepalensis,** Muell. Arg.; Fl. Br. Ind. v. 362; Gamble Darj. List 71. *M. oreophilus,* Muell. Arg. Vern. *Numbúngkor,* Lepcha.

A small tree. *Bark* ⅛ in. thick, light brown, with corky lenticels. *Wood* white, soft. *Pores* moderate-sized and large, rather scanty, often subdivided or in short radial lines. *Medullary rays* very fine, very numerous, equidistant.

Central and Eastern Himalaya, common about Darjeeling at 5–8000 ft., chiefly in second-growth forests; Khasia Hills at 4–5000 ft.

Manson, in "Darjeeling Working Plan," says the wood is used for cooly huts and fencing, and gives a light but firm and good charcoal.

E 3397. The Park, Darjeeling, 6500 ft. (Gamble).

3. **M. albus,** Muell. Arg.; Fl. Br. Ind. v. 429; Bedd. Fl. Sylv. ccviii.; Brandis For. Fl. 444; Gamble Darj. List 71; Talbot Bomb. List 187; Trimen Fl. Ceyl. iv. 64. *M. tetracoccus,* Kurz For. Fl. ii. 382. *Rottlera alba* and *tetracocca,* Roxb. Fl. Ind. iii. 829, 826. Vern. *Marleya,* Sylhet; *Jogi mallata,* Nep.; *Numbong,* Lepcha; *Rukenda,* Cingh.

A small evergreen tree. *Bark* thin, brownish-grey. *Wood* soft, white. *Pores* moderate-sized and large, often subdivided. *Medullary rays* very fine, very numerous, equidistant.

Sikkim Himalaya, ascending to 3000 ft.; Assam, Eastern Bengal and Chittagong; Western Gháts, Mysore and Ceylon.

A conspicuous tree, especially in second-growth forest. The leaves are covered beneath with dense white tomentum.

E 2422. Sivoke, Darjeeling Terai (Gamble) . . . . lbs. 31

4. **M. andamanicus,** Hook. f.; Fl. Br. Ind. v. 439. *M. muricatus,* Kurz For. Fl. ii. 384. Vern. *Ouk-mouk,* Burm.

A large evergreen shrub. *Wood* grey, moderately hard. *Pores* very small, often in radial lines. *Medullary rays* very fine, very numerous, equidistant. Numerous very fine transverse bars.

Andaman Islands.

B 2476. Andaman Islands (Kurz, 1874) . . . . lbs. 57

5. **M. philippinensis,** Muell. Arg.; Fl. Br. Ind. v. 442; Bedd. Fl. Sylv. t. 289; Brandis For. Fl. 444; Kurz For. Fl. ii. 381; Gamble Darj. List 71; Talbot Bomb. List 187; Trimen Fl. Ceyl. iv. 68. *Rottlera tinctoria,* Roxb. Fl. Ind. iii. 827. Vern. *Kamela, kamal, kambal, kúmila,* Pb.; *Kamila, kaimlar,* Kashmir; *Rúen, riúna, roina, roli,* Kumaon; *Raini,* Dehra Dún; *Kambel,* Jaunsar; *Rauni,* Garhwal; *Rohni,* Oudh; *Reoni,* Banda; *Rauni, rori,* C. P.; *Púnag, túng, kishur,* Beng.; *Sinduria,* Nep.; *Puroa, tukla,* Lepcha; *Baraiburi, sindurpong,* Mechi; *Chinderpang, machugan,* Gáro; *Gangai, puddum,* Ass.; *Kumala, sinduri, sundragundi,* Uriya; *Roré,* Sonthal; *Dorosindra,* Mal Pahari; *Pondika,* Koya; *Sendri,* Kurku; *Senduria,* Merwara; *Rolli,* Jeypore; *Gari, kúkú,* Berar; *Kapli, kapila,* Tam.; *Kúmkuma, vassuntagunda, chendra, sinduri, adiviqubatadu, pachichettu,* Tel.; *Koku,* Gondi; *Kurku, corunga-manje, saru-akasari, kunkuma, hulichellu,* Kan.; *Shendri, roem, kapila,* Mar.; *Ponnagam,* Mal.; *Hamparila,* Cingh.; *Tawthidin,* Burm.

A small tree with usually buttressed trunk. *Bark* ¼ in. thick, grey, inner substance red, marked by irregular cracks. *Wood* smooth, grey to light red, hard, close-grained, no heartwood. *Annual rings* indistinct. *Pores* small, uniformly distributed, scanty, often subdivided. *Medullary rays* uniform, very fine, very numerous, equidistant, the distance between them less than the diameter of the pores. Faint indications of transverse bars.

Sub-Himalayan tract and Lower Himalaya from the Indus eastwards, rising to 4500 ft.; Bengal; Central, Western and Southern India; Burma and the Andaman Islands; Ceylon.

One of the most universally distributed and most common of Indian forest trees. It is sometimes more or less gregarious, but more usually mixed with other species, both in the forests and in open scrub lands. In coppice woods it is a useful species, as it reproduces very well. The wood is of little value as timber, but is a useful fuel. The bark is occasionally used in tanning, but the chief product is the "Kamela" powder, which is a dye given by the red glands on the surface of the capsule. This powder is collected either dry by shaking the capsules in a bag, or wet by stirring them in water and collecting the sediment in cakes. The dye is used chiefly for dyeing silks a bright orange or flame colour. It is available in considerable quantities, but the cost of collection is considerable, so that it is not able properly to compete with mineral dyes of the same colour. The powder is also used in medicine. Bourdillon gives for the wood W = 44 lbs., P = 631; the average of specimens examined comes to 47 lbs. The leaves are not eaten by goats (Gleadow). The young leaves are damaged by a Scarabæid beetle, *Serica Alcocki*, Brensk., in the Dehra Dún ("Ind. Mus. Notes," iv. 217).

		lbs.
P 109.	Sutlej Valley, 3000 ft.	50
O 4822.	Thano Forest, Dehra Dún (Gleadow)	43
C 1178.	Ahiri Reserve, C.P. (R. Thompson)	43
E 599.	Bamunpokri, Darjeeling Terai (Manson)	51
E 2421.	" " " (Gamble)	49

47. CLEIDION, Blume.

Two species. *C. nitidum*, Thw. ex. Kurz For. Fl. ii. 391; Fl. Br. Ind. v. 444, is a small evergreen tree of the Andaman Islands and Ceylon.

1. **C. javanicum**, Blume; Fl. Br. Ind. v. 444; Bedd. Fl. Sylv. t. 272; Kurz For. Fl. ii. 390; Gamble Darj. List 71; Talbot Bomb. List 188; Trimen Fl. Ceyl. iv. 69. Vern. *Palap*, Lepcha; *Okuru*, Cingh.

An evergreen tree. *Bark* pale yellowish-grey, smooth. *Wood* greyish-white, soft. *Pores* moderate-sized, scanty. *Medullary rays* moderately broad, very indistinct.

Sikkim Himalaya, lower hills, up to 4000 ft.; Assam and the Khasia Hills; Chittagong, Burma and the Andaman Islands; evergreen forests of the Western Ghâts from the Konkan southwards; moist region of Ceylon.

		lbs.
W 4718.	Travancore (Bourdillon)	34

48. MACARANGA, Thouars.

Ten species, trees or shrubs, usually with large peltate leaves, and generally found in forest clearances and on old cultivated lands. One-half of the species are Himalayan, the other half South Indian or Burmese or of the Andaman Islands or Ceylon. *M. gmelinæfolia*, King; Fl. Br. Ind. v. 445, is a small tree of the Sikkim Himalaya, found near Kurseong; and *M. Gamblei*, Hook. f. a small scarce tree of the Dulka Jhar forest in the Darjeeling Terai. *M. Tanarius*, Muell. Arg.; Fl. Br. Ind. v. 447; Kurz For. Fl. ii. 388 (*Ricinus Mappa*, Roxb. Fl. Ind. iii. 690), is a small tree of the tropical forests of the Andaman Islands. *M. Brandisii*, King; Fl. Br. Ind. v. 453, is a tree found on Moolyet Hill in Tenasserim at 2–6000 ft. *M. digyna*, Muell. Arg.; Fl. Br. Ind. v. 453; Bedd. Fl. Sylv. ccxi.; Trimen Fl. Ceyl. iv. 71; Vern. *Ota, gal-ota*, Cingh., is a small tree of Ceylon. Beddome speaks of it as "very common," Trimen as "rare."

After a good deal of difficulty, I believe I have now succeeded in correctly identifying the Sikkim species, which were certainly wrongly given in Ed. 1.

Wood soft, spongy. *Pores* moderate-sized to large. *Medullary rays* uniform, very fine, closely packed.

1. **M. pustulata**, King; Fl. Br. Ind. v. 445. Vern. *Mallata*, Nep.; *Numro*, Lepcha.

A small tree, often gregarious. *Bark* grey, smooth. *Wood* soft, greyish-red. *Pores* moderate-sized to large, oval, elongated and subdivided. *Medullary rays* faint, uniform, very fine, very numerous.

Himalaya, from Kumaon at 4–5000 ft., to the Sikkim Hills at 3–6000 ft., chiefly on old clearings.

This is probably the most common of the "Mallata" trees so conspicuous on clearings in the Darjeeling Hills. It is recognized at once by the leaves not being peltate and by the glands on the rather large capsules. The growth is very fast; in 10 years the tree can reach a height of 40 ft., with a girth of 3 ft., and 2 rings per inch of radius are not uncommon. This tree and its allies are valuable as paving the way for more useful species and as acting as nurses to such trees as walnut, toon and chestnut. They die early, however, and as the wood easily decays, they soon disappear. The wood serves very well for temporary huts, fencing and similar purposes, that of the larger trees might serve for tea-boxes. It gives a fair charcoal.

		lbs.
E 2425.	Tukdah Forest, Darjeeling, 5000 ft. (Gamble)	29

2. **M. denticulata,** Muell. Arg.; Fl. Br. Ind. v. 446; Kurz For. Fl. ii. 387. Vern. *Dagdakti*, Mechi; *Lal mallata*, Nep.; *Laikezau*, Mechi; *Boura*, Beng.; *Modalu*, Ass.; *Chakro*, Garo; *Burna*, Chittagong; *Pawaing*, Magh; *Taungpetwun*, *ywetwun*, Burm.

A small evergreen tree. *Bark* grey, thin, smooth. *Wood* greyish-red, moderately hard, in structure similar to that of *M. pustulata.*

Sikkim Himalaya at 1–5000 ft.; Assam and Khasia Hills up to 3000 ft.; Chittagong to Tenasserim.

The remarks made under *M. pustulata* apply also to this species, which is, however, less common and is found at lower levels. The growth is very fast. It gives a red resin.

		lbs.
E 2424.	Chunbati, Darjeeling, 2000 ft. (Gamble)	33
B 2475.	Andaman Islands (Kurz, 1874)	—

3. **M. indica,** Wight; Fl. Br. Ind. v. 446; Bedd. Fl. Sylv. ccxi.; Kurz For. Fl. ii. 387; Talbot Bomb. List 188; Trimen Fl. Ceyl. iv. 70. Vern. *Jogi mallata*, Nep.; *Vatta thamarei*, Tam.

A small tree, often gregarious. *Bark* grey, smooth. *Wood* greyish-red, soft, in structure similar to that of *M. pustulata.*

Lower Himalaya from the Jumna (Malkot Hills, Dehra Dún) eastwards at 3–6000 ft.; Assam and Khasia Hills at 2–4000 ft.; Andaman Islands; hill ranges of S. India, from Cuddapah southwards, up to 5000 ft.; Ceylon, up to 4000 ft.

A very noticeable and handsome but short-lived tree of quick growth (3 rings per inch of radius in specimen). The wood is used for similar purposes to that of *M. pustulata.*

		lbs.
E 2426.	Pugraingbong, Darjeeling, 5000 ft. (Gamble)	22

4. **M. Roxburghii,** Wight; Fl. Br. Ind. v. 448; Talbot Bomb. List 188. *M. tomentosa*, Wight; Bedd. Fl. Sylv. t. 287; Trimen Fl. Ceyl. 70. Vern. *Vattakanni*, Tam.; *Chenthakanni*, Mysore; *Upligi*, *upalkai*, *upranti*, *kanchupranti*, Kan.; *Chanda*, Mar.; *Pulichinsaku*, Reddi; *Peemooha*, Kader; *Kenda*, *pat-kenda*, Cingh.

A small resinous tree. *Wood* reddish-brown, soft. *Pores* large, often oval and subdivided into 2 or 3, scanty, prominent on a radial section. *Medullary rays* very fine, very numerous, giving a fair silver-grain.

Hills of S. India, on both sides, common equally in the Circar mountains and in the Western Ghâts, from the plains up to 3000 ft.

Like the Sikkim species, this also comes up in old clearings and is very fast in growth. Beddome says it is used by planters to shade coffee. The wood is of little or no value; Bourdillon gives W = 27, P = 403 lbs. The gum is used in medicine and for taking impressions.

		lbs.
W 4589.	Travancore (Bourdillon)	26

Nos. 63 and 68 Ceylon Collection, new (Mendis), are both called *M. tomentosa;* one is an orange-coloured wood, the other a brown, and neither seems correct. No. 105 of the same collection is called *Ota* (*Mallotus fuscescens*). Now Trimen gives *Ota* as the Vernacular name of *Macaranga digyna.* The wood is a soft white one, and may belong to that species, but it is doubtful.

49. HOMONOIA, Lour.

Two species. *H. retusa*, Muell. Arg.; Fl. Br. Ind. v. 456; Bedd. Fl. Sylv. ccxii.; Brandis For. Fl. 445; Talbot Bomb. List 189, is a small shrub of river-beds in S. India, from the Konkan and Circars southwards.

1. **H. riparia,** Lour.; Fl. Br. Ind. v. 455; Bedd. Fl. Sylv. ccxii.; Brandis For. Fl. 445; Kurz For. Fl. ii. 401; Gamble Darj. List 72; Talbot Bomb. List 188; Trimen Fl. Ceyl. iv. 72. *Adelia neriifolia*, Roxb. Fl. Ind. iii. 849. Vern. *Kandágar*, Kumaon; *Khola ruis*, Nep.; *Mongthel*, Lepcha; *Taniki*, Tel.; *Sandeh*, Gondi; *Jeljambu*, Kurku; *Patada*, Reddi; *Kat-allari*, Mal.; *Momaka*, *yetagyi*, Burm.

An evergreen shrub. *Bark* brown. *Wood* grey or greyish-brown, moderately hard, close-grained. *Pores* scanty, moderately large, often subdivided. *Medullary rays* of two classes: few moderately broad and short and numerous long fine rays, which, on a thin section, appear as a succession of small black cells.

Rocky and stony river-beds, throughout India except in the north-west; Burma and Ceylon.

		lbs.
E 3303.	Sivoke, Darjeeling Terai (Gamble)	40

50. LASIOCOCCA, Hook. f.

1. **L. symphylliæfolia,** Hook. f.; Fl. Br. Ind. v. 456; Gamble Darj. List 72. Vern. *Bajadanti*, Nep.; *Ching*, Lepcha.

A moderate-sized evergreen tree. *Bark* very thin, white or light grey, peels off in thin flakes. *Wood* yellowish-white, hard, smooth, close-grained. *Annual rings* indistinct. *Pores* very small, numerous, uniformly distributed, sometimes in short radial lines. *Medullary rays* very fine, very numerous. Occasional very faint transverse bars.

Damp forests of the lower Darjeeling Hills.

Growth slow, about 10 rings per inch of radius. The section of the stem is very irregular, presenting deep sinuosities. The wood is hard and tough, and is used for punting-poles by the Tista boatmen. It is recommended for trial as a substitute for boxwood.

		lbs.
E 496.	Khookloong Forest, Darjeeling (Manson)	54
E 2429.	Tista Valley, near Sivoke, Darjeeling (Gamble)	59

51. RICINUS, Linn.

1. **R. communis,** Linn.; Fl. Br. Ind. v. 457; Roxb. Fl. Ind. iii. 689; Brandis For. Fl. 445; Kurz For. Fl. ii. 400; Gamble Darj. List 73; Talbot Bomb. List 189; Trimen Fl. Ceyl. iv. 72. The Castor Oil Plant or Palma Christi. Vern. *Rand, arand, arendi, ind*, Hind.; *Aneru*, Chenab; *Harnauli*, Salt Range; *Ind-rendi*, Kumaon; *Orer*, Nep.; *Raklop*, Lepcha; *Irandi*, Berar; *Tirki*, Guz.; *Sittamunuk*, Tam.; *Amadum, amudapu, amdi, sittamindi*, Tel.; *Nerinda*, Gondi; *Haralu*, Kan.; *Kyetsu*, Burm.; *Endaru*, Cingh.

A large shrub or small tree. *Bark* thin, light greyish-brown. *Wood* white, soft, light, with large central pith and occasionally an irregular brown heartwood. *Pores* moderate-sized, scanty, uniformly

distributed, often subdivided. *Medullary rays* numerous, of two classes, fine and moderately broad, bent round the pores, rather short.

Probably indigenous in Africa and Arabia: cultivated throughout India and often found run wild.

It is cultivated for the well-known oil which is expressed from its seeds and which is so largely used for burning, for lubricating machinery and in medicine. In Assam and adjoining regions it is cultivated for its leaves which are the food of the *Eri* silk-worm (*Attacus ricini*, Boisd.). The silk is strong and durable, and is in regular use among Assamese and Mechis for making their wearing apparel, and a considerable trade is done in cocoons with Calcutta and England (see Watt Dict. Econ. Products; "Ind. Mus. Notes," vol. i. 163; "Agric. Ledger," 19 (1894), and other works).

E 3277. Naltanpara, Western Dúars (Gamble).
Hough's American Woods, No. 189, vol. viii.

52. GELONIUM, Roxb.

Three species. *G. lanceolatum*, Willd.; Fl. Br. Ind. v. 459; Roxb. Fl. Ind. iii. 831; Bedd. Fl. Sylv. ccxiv.; Trimen Fl. Ceyl. iv. 73; Vern. *Suragada*, Tel.; *Kakkai-palai, varittula, potpottai*, Tam., is a small evergreen tree of the hills and dry evergreen forests on the eastern side of the Peninsula, reaching the West Coast in Cochin and Travancore, and extending to Ceylon. *G. bifarium*, Roxb. Fl. Ind. iii. 830; Fl. Br. Ind. v. 459; Kurz For. Fl. ii. 410, is a small evergreen tree of the bamboo jungles on Middle Andaman Island.

1. G. multiflorum, A. Juss.; Fl. Br. Ind. v. 459; Kurz For. Fl. ii. 409. *G. fasciculatum*, Roxb. Fl. Ind. iii. 862. Vern. *Kakra*, Uriya; *Sethanbaya*, Burm.

An evergreen tree. *Bark* ½ in. thick, granular, outside greyish-white with longitudinal streaks. *Wood* hard, smooth, close- and even-grained, yellowish-white, with a waxy smell. *Pores* moderate-sized, very scanty, usually subdivided or in short radial strings. *Medullary rays* very fine, very numerous, joined by minute, faint, light-coloured bars.

Bengal, Orissa and the N. Circars; Chittagong and Burma.

A pretty tree, sometimes cultivated in gardens. Growth moderate, 6 rings per inch of radius.

		lbs.
C 3548.	Khurdha Forests, Orissa (Gamble)	—
C 3828.	Surada Forests, Ganjam „	47

53. CHÆTOCARPUS, Thw.

Three species. *C. coriaceus*, Thw.; Fl. Br. Ind. v. 461; Bedd. Fl. Sylv. ccxiv.; Trimen Fl. Ceyl. iv. 75; Vern. *Hédoka, hedawaka*, Cingh., is a moderate-sized tree of the moist region of Ceylon; where also, but more scarce, is found *C. pubescens*, Hook. f.

1. C. castanocarpus, Thw.; Fl. Br. Ind. v. 460; Bedd. Fl. Sylv. t. 284; Kurz For. Fl. ii. 409. Vern. *Búlkokra*, Beng.; *Hédoka, hedawaka*, Cingh.

A moderate-sized tree. *Wood* light red, moderately hard, close-grained. *Pores* small, scanty, in short radial lines. *Medullary rays* very fine, very numerous. Narrow wavy concentric bands fairly regular and prominent.

Khasia Hills, Eastern Bengal, Burma, Andaman Islands and Ceylon.

The wood is said to be used in Ceylon for building.

	lbs.
No. 34, Ceylon Collection, old (*C. pungens*); No. 46, new	58

54. BALIOSPERMUM, Blume. Five species, three of which are small shrubs of Assam and the Khasia Hills. *B. corymbiferum*, Hook. f.; Fl. Br. Ind. v. 463; Vern. *Poguntig*, Lepcha, is a shrub of Eastern Nepal and Sikkim at 4-5000 ft. The most

common species is *B. axillare*, Blume; Fl. Br. Ind. v. 461. (*B. montanum*, Muell. Arg.; Kurz For. Fl. ii. 410, *Croton polyandrus*, Roxb. Fl. Ind. iii. 682), a stout subherbaceous leafy shrub common in most parts of India and Burma, often on road-sides, or in savannah forests.

55. CNESMONE, Blume. *C. javanica*, Blume; Fl. Br. Ind. v. 466; Kurz For. Fl. ii. 399, is an evergreen large climbing shrub of tropical forests near Rangoon, extending northwards to Bengal, Sylhet and the Khasia Hills.

Tribe VI. HIPPOMANEÆ.

56. SAPIUM, P. Br.

Six species, one of which is an introduced tree. *S. eugeniæfolium*, Ham.; Fl. Br. Ind. v. 470, is a glabrous tree of the Central and Eastern Himalaya, from Kumaon 3–4000 ft. to Sikkim, Assam and the Khasia Hills; while *S. virgatum*, Benth. is a scarce tree found near Moulmein.

Wood soft, spongy. *Pores* moderate-sized to large, scanty. *Medullary rays* very fine, uniform, closely packed. Faint concentric lines.

1. S. baccatum, Roxb. Fl. Ind. iii. 694; Fl. Br. Ind. v. 470; Gamble Darj. List 73. *Excæcaria baccata*, Muell. Arg.; Brandis For. Fl. 441. *Carumbium baccatum*, Kurz For. Fl. ii. 412. Vern. *Pudlikat, lal kainjal*, Nep.; *Adamsali, larrna*, Ass.; *Billa*, Sylhet; *Lelun*, Burm.

A large deciduous tree. *Wood* grey, soft. *Pores* moderate-sized and large, often subdivided. *Medullary rays* very fine, regular, closely-packed.

Sikkim Himalaya, in the lower hills and Terai; Assam, Khasia Hills and Sylhet; Chittagong and Burma.

A fine tree, especially handsome when in young leaf, when the leaves are of an orange-red colour. Roxburgh writes of it as a "useful timber tree," but Kurz evidently thinks the wood of poor quality. The specimens are believed to be accurately identified, but this is not quite certain.

		lbs.
E 3340.	Assam	—
E 1962.	Chittagong (Chester)	28

2. S. sebiferum, Roxb. Fl. Ind. iii. 693; Fl. Br. Ind. v. 470; Gamble Darj. List 73; Talbot Bomb. List 189. *Excæcaria sebifera*, Muell. Arg.; Brandis For. Fl. 441. *Carumbium sebiferum*, Kurz For. Fl. ii. 412. The Chinese Tallow tree. Vern. *Mom-china*, Beng.; *Tár-charvi*, Dehra Dún.

A moderate-sized deciduous tree. *Bark* grey, with shallow, vertical cracks. *Wood* white, moderately hard. *Pores* small to large, often subdivided. *Medullary rays* very fine, very numerous, the distance between the rays less than the transverse diameter of the pores. Numerous very fine, wavy oblique bars across the rays.

Indigenous and cultivated in China and Japan. Introduced and cultivated throughout Northern India.

Growth rather fast, 6 rings per inch of radius. The white wax round the seeds gives the Chinese tallow, which is separated by boiling in water, and is used in China and Japan for candles. Roxburgh says it is bad for burning, that it only remains firm at a cool temperature, and that it easily becomes rancid. It melts at 104° F. The seeds give an oil, and the leaves a black dye. It is a handsome tree, somewhat like Sissú in foliage, and often planted for ornament, the leaves turning orange or scarlet before falling. Experiments have been made by Babu Birbál at Dehra Dún, and the wax was extracted and made into cakes, but the process was tedious and the results not very satisfactory, so that the culture of the tree for wax is not recommended. The

tree is very easily grown; it will reproduce from cuttings, and gives both coppice shoots and root suckers.

The tree is often defoliated in Dehra Dún by the lava of the moth *Ophiusa Melicerte*, Drury.

		lbs.
O 3114.	Dehra Dún (Col. Bailey). Nordlinger's Sections, vol. 8.	32

3. S. indicum, Willd.; Fl. Br. Ind. v. 471; Roxb. Fl. Ind. iii. 692; Talbot Bomb. List 189; Trimen Fl. Ceyl. iv. 75. *Excœcaria indica*, Muell. Arg.; Bedd. Fl. Sylv. ccxv.; Brandis For. Fl. 441; Kurz For. Fl. ii. 413. Vern. *Húrua*, *batúl*, Beng.; *Húrna*, Mar.; *Kiri-makulu*, Cingh.

A small evergreen tree. *Bark* smooth, grey. *Wood* soft, white, with small brown heartwood. *Pores* moderate-sized and large, oval, often subdivided. *Medullary rays* equally distributed, very fine, closely packed. The transverse diameter of the pores is greater than the distance between the rays.

Sundarbans and tidal forests of Tenasserim, the South Konkan and Ceylon.

The wood is used in the Sundarbans for fuel. The juice of the tree is very poisonous, and the seeds are used to poison fish.

		lbs.
E 409.	Sundarbans (Richardson)	29

4. S. insigne, Benth.; Fl. Br. Ind. v. 471; Talbot Bomb. List 189; Trimen Fl. Ceyl. iv. 76. *Excœcaria insignis*, Muell. Arg.; Bedd. Fl. Sylv. ccxiv.; Brandis For. Fl. 442. *Carumbium insigne*, Kurz For. Fl. ii. 412. Vern. *Dúdla*, *bilodar*, *biloja*, *karálla*, *ledra*, Pb.; *Khinna*, *khina*, *lienda*, *lendwa*, *linda*, *khirni*, Hind.; *Garpa shola*, Anamalais.

A deciduous tree, usually small and twisted, but occasionally of large size and straight-stemmed with spreading branches, diœcious. *Bark* grey, smooth, shining, with large, broad, longitudinal wrinkles when young, very rough, corky and deeply fissured when old. *Wood* white, greyish-white or grey, soft, spongy. *Annual rings* faintly marked. *Pores* moderate-sized and large, subdivided, and often in short radial lines, very scanty, prominent on a radial section. *Medullary rays* very fine, indistinct.

Himalaya, outer ranges from the Beas eastwards, ascending to 5000 ft., usually on dry, hot, rocky slopes, not recorded from Sikkim; upper mixed forests and along streams in Chittagong and the Pegu Yoma; hill ranges of the Ceded Districts of Kurnool and Cuddapah; coast of the Konkan and N. Kanara, both on dry rocky soils and in the Ghát forests, extending south to the Nilgiris (Sispara) and Travancore; dry region of Ceylon.

An interesting tree from its distribution and from the fact that, although the common variety seems to prefer dry, rocky, hot slopes, another form (? var. *malabarica*) is found in the moist evergreen forests. On good soil it can grow very large, *e.g.* a fine male tree in Lytton Road, Dehra Dún. The male trees are much more common than the female. The growth is rather fast, 4 to 7 rings per inch of radius. The wood is said to be one of those used for the cylinders of native drums. The milk is acrid and said to be poisonous.

		lbs.
H 103.	Bhajji, Simla, 4000 ft.	29
H 615.	Kulu, 5000 ft. (Pengelly)	23
H 4820.	Maidan, Dehra Dún, 4000 ft. (Gamble)	30

57. EXCÆCARIA, Linn.

Seven species. *E. acerifolia*, F. Didrichs.; Fl. Br. Ind. v. 473; Brandis For. Fl. 441; Vern. *Pútkia*, *phutkia*, Kumaon, is a large glabrous milky shrub or small tree of the Central Himalaya in Kumaon and Nepal at 5–6000 ft.; also of the Khasia Hills at 4000 ft. The root is used in medicine. *E. holophylla*, Kurz For. Fl. ii. 414; Fl.

Br. Ind. v. 473, is an evergreen tree of the tropical forests of Martaban and Tenasserim, and *E. rectinervis*, Kurz, a small tree of the Nicobar Islands.

E. crenulata, Wight; Fl. Br. Ind. v. 473; Trimen Fl. Ceyl. 77 (*E. cochinchinensis*, Muell. Arg. and *E. oppositifolia*, Muell. Arg.; Bedd. Fl. Sylv. ccxv.), is a small tree of the Western Ghâts from Coorg southwards and Ceylon, ascending to 7000 ft., not uncommon in the drier Nilgiri sholas about Coonoor. *E. robusta*, Hook. f.; Fl. Br. Ind. v. 474; Talbot Bomb. List 190, is a small tree of the Konkan and Coorg. *E. oppositifolia*, Griff. is a small tree of Sylhet, and perhaps also of Burma.

1. E. Agallocha, Linn.; Fl. Br. Ind. v. 472; Roxb. Fl. Ind. iii. 686; Bedd. Fl. Sylv. ccxv.; Brandis For. Fl. 442; Kurz For. Fl. ii. 414; Talbot Bomb. List 190; Trimen Fl. Ceyl. iv. 77. Vern. *Gangwa, geor, uguru, geria*, Beng.; *Thilla, chilla*, Tel.; *Tilai*, Tam.; *Geva, surúnd, phungali*, Mar.; *Tala kiriya*, Cingh.; *Tayaw, kayaw*, Burm.; *Yekin*, Burm., in the Andamans.

An evergreen tree which exudes poisonous milk. *Bark* grey, smooth, shining, with numerous round prominent lenticels. *Wood* very soft, spongy. *Pores* small, scanty, usually in radial lines. *Medullary rays* very numerous, extremely fine.

Coast and tidal forests of both sides of the Peninsula of India; Burma and the Andaman Islands; Ceylon.

A common tree in all parts of the Sundarbans, associated with *gorán* in the western and with *sundri* in the eastern forests. Home in his Sundarbans List of 1874 says: "Grows occasionally to 5 ft. in girth and 40 ft. in height, though generally cut for 'posts when of small girth. It is a useful wood for general carpentering purposes, 'such as toys, bedsteads, tables, etc., a white timber; the juice which exudes from 'the bark when green is very poisonous." Schlich, in "Ind. Forester," i. 8, says the same. Roxburgh says it is only used for charcoal and firewood.

		lbs.
E 396.	Sundarbans (Richardson)	24
E 3642.	„ (Gamble)	—
B 2477.	Andaman Islands (Kurz, 1866)	28
D 4116.	South Arcot (Wooldridge)	24

ORDER C. URTICACEÆ.

A large and important Order, containing some of the most useful trees and shrubs in the Indian forests. They are more especially useful as fibre-plants, but some species give valuable timbers, others indiarubber, and others edible fruits. The woody plants of the Order are contained in 6 Tribes with 27 genera, viz.—

Tribe I. Ulmeæ	Ulmus, Holoptelea.
„ II. Celtideæ	Celtis, Trema, Gironniera.
„ III. Moreæ	Pseudostreblus, Taxotrophis, Phyllochlamys, Streblus, Broussonetia, Allæanthus, Plecospermum, Morus.
„ IV. Artocarpeæ	Ficus, Antiaris, Cudrania, Artocarpus, Balanostreblus.
„ V. Conocephaleæ	Conocephalus, Hullettia.
„ VI. Urticeæ	Laportea, Boehmeria, Pouzolzia, Sarcochlamys, Villebrunea, Debregeasia, Maoutia.

The chief genera yielding timber are: *Artocarpus, Ulmus, Celtis* and *Morus;* caoutchouc is given especially by the Indiarubber fig, *Ficus elastica;* while most of the genera, especially *Broussonetia, Antiaris* and *Boehmeria* give fibres of value. So also does the common weed of roadsides and waste-places, the Hemp, *Cannabis indica*, Linn. *Morus, Artocarpus* and *Ficus* give important fruits.

As an indiarubber-giving plant, the *Castilloa elastica*, Cerv. of Mexico has been introduced and successfully grown in suitable places in South India. It is very easily propagated in a moist warm climate, and its growth is very quick.

There is no general Family character in the wood, except that the

medullary rays are usually prominent, fine to moderately broad and not very numerous. In colour, *Morus, Artocarpus, Plecospermum* and *Ulmus* have yellow, yellowish-brown or brown woods; *Boehmeria* a red wood; *Holoptelea, Celtis* and *Streblus* white woods; the rest mostly grey or light brown woods. Most species have light or only moderately heavy woods. There are three types of structure more or less apparent:

I. *Artocarpus* type. *Pores* isolated or in groups, not in concentric lines: *Artocarpus, Morus, Antiaris, Boehmeria, Trema, Debregeasia.*

II. *Ulmus* type. *Pores* united in more or less concentric or oblique lines: *Ulmus, Holoptelea, Celtis.*

III. *Ficus* type. *Wood* in alternate bands of soft and firm texture, *pores* very scanty: *Ficus, Streblus.*

TRIBE I. ULMEÆ.

1. ULMUS, Linn.

The Indian elms are four, two of the Western and one of the Eastern Himalaya, and a fourth, *U. parvifolia*, Jacq.; Fl. Br. Ind. v. 481; Brandis For. Fl. 434; (*U. virgata*, Roxb. Fl. Ind. ii. 67) of the higher inner Himalaya, in Western Tibet at 10,000 ft., a shrub or small tree.

The common elm of Europe is *U. campestris*, Spach; Brandis For. Fl. 433, and the Wych elm is *U. montana*, Smith.

1. **U. Wallichiana**, Planch.; Fl. Br. Ind. v. 480; Brandis For. Fl. 432, t. 51. Himalayan Elm. Vern. *Káin, khái, bren, brera, brán, barare, bránkul, brori, amrái, marári, marrál, marrún, marazh, makshári, manderung, maldung, maral, permani, shko, kummar, hembra,* Pb.; *Mored, pabúna, chambar máya,* N.-W. Provinces; *Emrói, imroi,* Jaunsar.

A large deciduous tree. *Bark* grey, rough, with diagonal cracks, exfoliating in diamond-shaped scales. *Wood* greyish-brown, moderately hard, somewhat scented, the scent sometimes faintly resembling that of the Lily of the Valley; sapwood light in colour. *Annual rings* marked by a soft porous belt in the spring wood, the outer part of the annual ring consisting of firm and hard tissue. *Pores* in spring wood moderate-sized and large, closely packed; in the autumn wood small and very small, arranged in oblique, undulating, concentric lines. *Medullary rays* fine and moderately broad, giving on a radial section a prominent and handsome silver-grain, the grain on the tangential section marked in lines by the larger pores.

Western Himalaya, from the Indus to Nepal at 3–10,000 ft., usually in ravines and valleys in the hills or in damp places in the fir forests with a moist aspect.

This is a large tree with a fine timber, which deserves to be much better known than it is as a furniture wood. If carefully cut up so as to get the best of the silver-grain, it looks very handsome and takes a good polish. It is in use locally in places where Deodar and *Pinus excelsa* are not available, and in forest fellings care should always be taken to retain the best part and keep it on sale, so as to enable it to be better known. But, though widely enough distributed in its region, the Himalayan Elm is nowhere a common tree, so that no great supply can ever be expected. The weight of the wood comes to about 36 lbs. per cubic foot. The growth is ordinarily slow, the quickest grown that I have met with having 6 rings per inch of radius. The tree occasionally grows of very large size, occasionally reaching 80 or 90 ft. in height, and 12 to 16 and even 24 ft. in girth (Brandis). Gleadow, in "Ind. Forester," xxvi., Appx., p. 50, mentions trees below Mundali in Jaunsar of 12½ to 16½ ft. in girth, and says "the elm has a very handsome silver-grain." The bark contains a strong fibre,

which is made into cordage, sandals and slow-matches (Brandis). The leaves lopped for cattle-fodder, and planted near villages for that purpose.

			lbs.
H	59.	Nagkanda, Simla, 8000 ft.	40
H	122.	Manali, Kulu, 7000 ft. (Stenhouse)	35
H	917.	Hazara, 7000 ft. (Baden-Powell)	32
H	3175.	Dungagalli, Hazara, 7000 ft. (Wild)	—

Nordlinger's Sections, vol. 9 (Tab. XIII. 1).

2. **U. villosa**, Brandis in Ind. For. xxv. 229. Vern. *Yúmbok*, Ladak; *Brán*, *brahmi*, *kái*, *morún*, *marál*, *maúru*, *mannu*, *mandu*, *mamji*, *marn*, *meru*, *merinu*, *bhamji*, *bhamni*, *chipál*, Pb.; *Marn*, Kulu; *Imbri*, Bashahr; *Maldang*, Kunawar; *Narag*, Jaunsar.

A shrub or small tree. *Bark* brown, surface whitish, between deep dark-coloured, longitudinal, regular furrows, running diagonally into each other. *Wood* grey with darker streaks, hard, otherwise the structure is the same as that of *U. Wallichiana*.

Valleys of the Punjab Himalaya, up to 10,500 ft., extending eastwards to the Pabar Valley.

This is the small-leaved Elm referred in the Fl. Br. Ind. to *U. Wallichiana*. Brandis at first considered it to belong to *U. campestris*, but has since published it as a separate species. The wood is said to be even better than that of *U. Wallichiana*.

			lbs.
H	123.	Manali, Kulu, 7000 ft. (Stenhouse)	37
H	918.	Hazara, 7000 ft. (Baden-Powell)	34
H	3164.	Dungagalli, Hazara, 7000 ft. (Wild)	—

3. **U. lancifolia**, Roxb. Fl. Ind. ii. 66; Fl. Br. Ind. v. 480; Kurz For. Fl. ii. 473; Gamble Darj. List 73. Vern. *Lapi*, Nep.; *Thalè*, Burm.

A large deciduous tree. *Bark* brown, thick. *Wood* light red, hard. *Pores* small, usually surrounded by loose tissue and joined by pale concentric lines which are sometimes broken. *Medullary rays* fine to moderately broad, the distance between them about equal to the transverse diameter of the pores.

Central and Eastern Himalaya from Kumaon to Bhutan, up to 5000 ft.; Khasia Hills at 1–3000 ft.; Chittagong and Burma.

E 3343. Singtam, Darjeeling, 1500 ft. (Gamble).

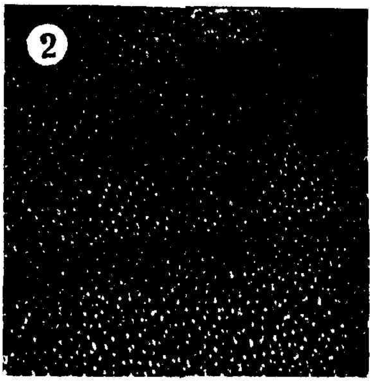
2. HOLOPTELEA, Planch.

1. **H. integrifolia**, Planch.; Fl. Br. Ind. v. 481; Talbot Bomb. List 191; Trimen Fl. Ceyl. iv. 80. *Ulmus integrifolia*, Roxb. Fl. Ind. ii. 68; Bedd. Fl. Sylv. t. 310; Brandis For. Fl. 431; Kurz For. Fl. ii. 473. Vern. *Papri*, *khulen*, *arján*, *rajáin*, *kachám*, Pb.; *Banchilla*, Saharanpur; *Papar*, *kanju*, Kumaon; *Papri*, Bhartpur; *Dhamna*, *kúnj*, Oudh; *Karanji*, *chilbil*, *chilmil*, *kúmba*, *kúnja náli*, *kandru*, *beganu*, C.P.; *Chilla*, Banda; *Chorha*, Sonthal; *Churla*, Mal Pahari; *Chillar*, Jeypore; *Pulari*, Reddi; *Daurango*, Uriya; *Karinji*, Gondi; *Karanjel*, Kurku; *Aya*, *ayil*, *velayil*, *kauchia*, Tam.; *Namli*, *navili*, *tapasi*, *nali*, *pedda-nowli-eragu*, Tel.; *Wawali*, *papara*, Mar.; *Ras bija*, Kan.; *Thapsi*, Mysore, Coorg; *Kaládri*, Hassan; *Aval*, Mal.; *Goda-kirilla*, Cingh.; *Myaukseik*, *pyaukseik*, Burm.

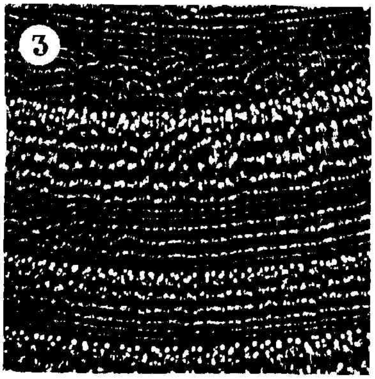
A large deciduous tree. *Bark* ½ in. thick, whitish-grey, exfoliating in long, irregular flakes, soft, with an offensive smell when fresh, like the leaves and branchlets. *Wood* light yellowish-grey, moderately hard, no heartwood. *Annual rings* indistinct. *Pores* small, uniformly distributed, joined by very fine and often faint lines of soft texture, frequently filled with a white substance, marked on a vertical section. *Medullary rays* fine, short, undulating, uniform, equidistant, visible on a radial section; the distance between the rays equal to the transverse diameter of the pores.

XIII.

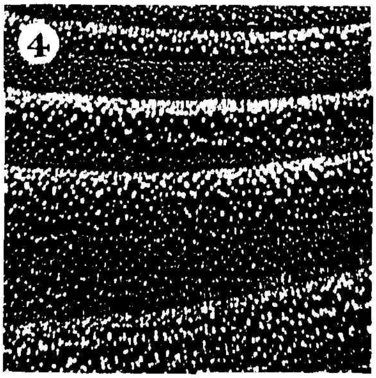
ULMUS WALLICHIANA.



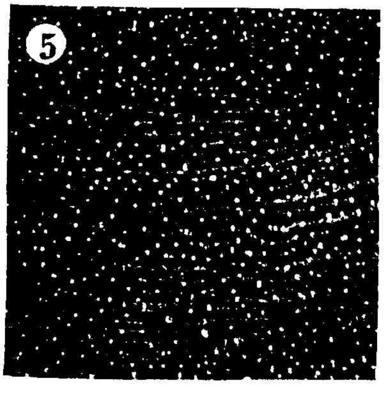
HOLOPTELEA INTEGRIFOLIA.



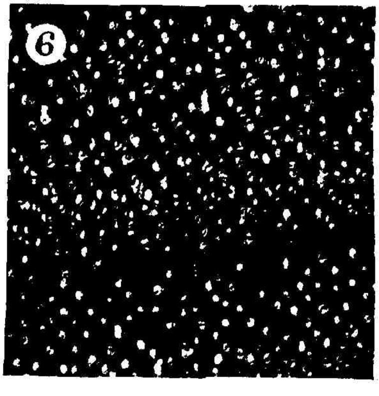
CELTIS AUSTRALIS.



MORUS ALBA.



FICUS BENJAMINA.



ARTOCARPUS HIRSUTA.

(*Magnified* 3½ *times.*)

Throughout the greater part of India, except in the higher hills; Eastern Himalaya and Assam, usually in deciduous forest; Upper Burma; dry region of Ceylon.

A common tree, but of little importance. It is usually much branched or twisted. The wood is strong, but is used but little; Brandis mentions its use for building, carts and carving. The growth is fast, usually about 6 rings per inch, but sometimes as fast as 2 rings. The leaves are lopped for cattle-fodder, and an oil is extracted from the seed in the Melghát. On an average, W = 40 lbs., which is the value given by H. H. O'Connell for Coimbatore wood.

		lbs.
P 445.	Ajmere	42
O 264.	Garhwal (1868)	46
O 3002.	„ (1874)	41
O 392.	Oudh (Wood)	34
C 1148, 1181.	Ahiri Reserve, Central Provinces (R. Thompson)	37
B 1416, 1419.	Tharrawaddy, Burma	42

Nordlinger's Sections, vol. 8 (*Ulmus integrifolia*) (Tab. XIII. 2).

TRIBE II. CELTIDEÆ.

3. CELTIS, Linn.

Four species. *C. cinnamomea*, Ldl.; Fl. Br. Ind. v. 482; Kurz For. Fl. ii. 472; Trimen Fl. Ceyl. iv. 81, t. 86 (*C. dysodoxylon*, Thw.; Bedd. Fl. Sylv. ccxix.); Vern. *Sedongtagla*, Lepcha; *Gurenda*, Cingh., is an evergreen tree of the lower Sikkim Himalaya, Assam, Chittagong, Burma and Ceylon. The wood is characterized by an exceedingly unpleasant scent, and is used in medicine in Ceylon.

Wood light-coloured, moderately hard, no heartwood, seasons well. *Annual rings* distinctly marked by belts of large pores. The *pores* in the outer portion of the annual ring are small, and generally arranged in more or less concentrically disposed groups.

1. **C. australis**, Linn.; Fl. Br. Ind. v. 482; Brandis For. Fl. 428. *C. caucasica*, Willd. Nettle tree. *Micocoulier*, Fr. Vern. *Brimij*, Kashmir; *Tagho, takhúm*, Afgh.; *Ku*, Sutlej; *Kharak, kharik*, Simla to Kumaon; *Kharak chena*, Dehra Dún.

A moderate-sized deciduous tree. *Bark* bluish-grey, smooth with horizontal wrinkles. *Wood* grey or yellowish-grey, with irregular streaks of darker colour, hard. *Annual rings* marked by an irregular belt of moderate-sized and large to very large pores in the spring wood; in the rest of the layer *pores* gradually getting smaller towards the outer limit, where they are very small and arranged in wavy, interrupted, concentric lines. *Medullary rays* moderately broad and fine, rather short. Pores conspicuous on a vertical section.

Hills of Baluchistan and Afghanistan; Western Himalaya eastwards to Nepal, ascending to 8000 ft.: westwards through South Europe.

A common tree in the Western Himalaya, both in forests and around villages, where it is often planted to be lopped for cattle-fodder. It is also cultivated near shrines and graveyards in the Kuram region (Aitchison). The wood is tough and strong, and is used for oars, tool-handles, sticks and other purposes requiring toughness and elasticity. In Southern France the wood is much esteemed for similar uses, and the tree is cultivated in small closely-grown coppice woods in order to produce suitable pieces; it is also considered an excellent fuel (Mathieu and Fliche, p. 295). The growth is moderate, about 8 to 9 rings per inch. Mathieu gives the weight at 37 to 50 lbs., the average of specimens examined gives 45 lbs.

		lbs.
P 4473, 4474.	Baluchistan (Lace)	—
H 932, 3169.	Hazara	44
H 36.	Julung, Simla, 5000 ft.	47

Nordlinger's Sections, vol. 1 (Tab. XIII. 3).

Var. *eriocarpa* (*C. eriocarpa*, Dcne.; Brandis For. Fl. 429); Vern. *Bathar, battaman*, Ph.; *Akata, batálú*, Hind., is a variety found in the West Himalaya.

2. **C. tetrandra**, Roxb. Fl. Ind. ii. 63; Fl. Br. Ind. v. 482; Brandis For. Fl. 429; Kurz For. Fl. ii. 472; Gamble Darj. List 73; Talbot Bomb. List 191. *C. trinervia*, Roxb. Fl. Ind. ii. 65. *C. serotina*, Planch.; Bedd. Fl. Sylv. ccxviii. *C. Roxburghii*, Planch.; Bedd. Fl. Sylv. t. 312. *C. Hamiltoni*, Planch., and *C. mollis*, Wall.; Kurz For. Fl. ii. 472. Vern. *Kúmsúm, sungsúm*, Lepcha; *Haktapatia*, Ass.; *Hadhuwa, adona*, Badaga; *Brumaj*, Mar.

A tall tree. *Bark* grey. *Wood* greyish-white, moderately hard. *Pores* numerous, frequently subdivided, those of the inner edge of each annual ring large, forming a narrow, porous belt; those of the outer portion moderate-sized and scattered or arranged in oblique wavy lines. *Medullary rays* moderately broad and fine, prominent on a radial section as a silver-grain of long narrow plates.

Central and Eastern Himalaya from Kumaon to Assam, up to 3000 ft.; Khasia Hills, Chittagong and Burma; Behar, Circars and Hills of the Eastern Deccan; Western Ghâts from the Konkan southwards, very frequent and fine in the Nilgiris up to 7000 ft.

A fine tree of similar character and similar uses to *C. australis*. The wood is said to be used in Assam for planking and canoes. The growth is moderate, 5 to 10 rings per inch of radius.

		lbs.
E 669.	Bamunpokri, Darjeeling Terai (Manson)	36
E 707.	Great Rangít Valley, Darjeeling „	37
W 4095.	Fairlawns, Ootacamund, 6500 ft. (Gamble)	38
W 4197.	Ootacamund, Nilgiris, 6500 ft. „	42

3. **C. Wightii**, Planch.; Fl. Br. Ind. v. 483; Bedd. Fl. Sylv. ccxviii.; Trimen Fl. Ceyl. iv. 81. *Solenostigma Wightii*, Bl.; Kurz For. Fl. ii. 471. *Bosia trinervia*, Roxb. Fl. Ind. ii. 87. Vern. *Vella thorasay*, Tam.; *Tella-káká-mushti*, Tel.; *Hadawa*, Badaga; *Maditella*, Cingh.

A small evergreen tree. *Wood* white or greyish-white, very hard, close-grained, smooth, shining. *Annual rings* indistinctly marked by a narrow belt without pores; elsewhere *pores* small, enclosed in narrow, undulating, concentric, interrupted lines of soft tissue. *Medullary rays* fine, numerous, uniform and equidistant.

Hills of the Circars, rising at Mahendragiri to 4000 ft.; hills of the Eastern Ghâts in Golgonda, Rumpa and Kondapalle; hills of Kurnool and Cuddapah; drier parts of the Nilgiris at 4–6000 ft.; tropical forests of the Andaman Islands; Ceylon.

		lbs.
D 4177.	Mantralama Pass, Kurnool, 2000 ft. (Gamble)	61
D 1087.	Pulney Hills, Madura (Beddome)	53

4. TREMA, Lour.

Four species. *T. timorensis*, Blume; Fl. Br. Ind. v. 483; Kurz For. Fl. ii. 469, is a small evergreen tree of Tenasserim. *T. amboinensis*, Blume; Fl. Br. Ind. v. 484 (*Sponia velutina*, Planch.; Bedd. Fl. Sylv. ccxix., *Celtis tomentosa*, Roxb. Fl. Ind. ii. 66), is a small tree of the Sikkim Terai, W. Dúars; Assam, Sylhet, Burma and the Andaman Islands.

Wood light coloured, soft or moderately hard. *Pores* small or moderate-sized. *Medullary rays* fine and moderately broad.

1. **T. orientalis**, Blume; Fl. Br. Ind. v. 484; Kurz For. Fl. ii. 468 (var. *orientalis* only); Gamble Darj. List 73; Talbot Bomb. List 191; Trimen Fl. Ceyl. iv. 82. *Sponia orientalis*, Planch.; Bedd. Fl. Sylv. ccxix.; Brandis For. Fl. 430. *Sponia Wightii*, Planch.; Bedd. Fl. Sylv. t. 311. *Celtis orientalis*, Linn.; Roxb. Fl. Ind. ii. 65. Indian Nettle tree or Charcoal tree. Vern. *Badu manu*, C.P.; *Kooail*, Nep.;

Tugla, Lepcha; *Param*, Mechi; *Jiban*, Beng.; *Jupong, phakram, jigini, sapong, sempak, amphak, opang*, Ass.; *Jhunjun*, Monghyr; *Jawhar*, Sonthal; *Kokoara*, Mal Pahari; *Rukni*, Baigas; *Rarunga*, Kól; *Grui*, Khond; *Ranambada, kapashi, gol, kargol*, Mar.; *Gada-nelli*, Tel.; *Gorklu*, Kan.; *Mini, mudalei*, Tam.; *Womé*, Badaga; *Ola*, Kader; *Ama, pottama*, Mal.; *Ratthi, ambarki, ayali*, Trav. Hills; *Gedumba*, Cingh.; *Satsha*, Burm.

A small, fast-growing and short-lived tree. *Bark* thin, greyish-brown, with numerous lenticels. *Wood* light reddish-grey, soft. *Pores* moderate-sized, often subdivided, uniformly distributed. *Medullary rays* fine, numerous, uniform.

Sub-Himalayan tract and Lower Himalaya from the Jumna eastwards, very scarce to the west; Central, Western and Southern India, except in the very dry tracts and up to 5000 ft.; Assam, Eastern Bengal and Chittagong; Ceylon, common.

A rather important small tree, as it is almost always, in the country it prefers, the first woody plant to appear in forest clearings, on fallow land, on landslips or banks, in fact, wherever it has a chance; and, as Beddome remarks, "it is curious how the tree springs up in all places where heavy moist forest has been cleared away for 'coffee or other purposes, although there may not be a plant of it within miles." For a shade plant in plantations on cleared land, or for reclothing landslips, it is almost unequalled. It is used to plant to shade coffee in Mysore and Wynaad. Its growth is extremely fast. The tree from which I cut the specimen described, No. E 2446, in 1874, near the Sivoke Forest Resthouse, was 5 years old, and had reached a height of 25 ft. and a girth of 40 inches, equivalent to about 1¼ rings per inch of radius. The wood makes good gunpowder charcoal, but is not very good as firewood. The bark gives a fibre which is used to tie the rafters of native houses and for binding loads; in Assam it is used to make the coarse *Amphak* cloth. Bourdillon gives W = 30 lbs., P = 297.

		lbs.
O 5090.	Dehra Dún (Babu U. N. Kanjilal)	24
E 2446.	Sivoke, Darjeeling Terai (Gamble)	28

2. **T. politoria**, Planch.; Fl. Br. Ind. v. 484; Gamble Darj. List 73. *Sponia politoria*, Planch.; Brandis For. Fl. 430. Vern. *Bantamman, kanglu, khúri*, Pb.; *Jáun, khasaroa, márni, bátu*, N.-W. P.; *Banharria*, Oudh; *Khagshi, kúri*, Dehra Dún; *Khardál*, Saharanpur; *Kháoi, khúksi, kooail*, Nep.; *Tuksat*, Lepcha; *Jawhar*, Sonthal; *Sitki*, Mal Pahari.

A small evergreen tree. *Bark* brown, rough, often with longitudinal wrinkles, inner bark red. *Wood* light brown or greyish-brown, moderately hard, splits and cracks in seasoning. *Annual rings* marked by a belt of firmer tissue on the outer edge of each ring. *Pores* small, often subdivided, uniformly distributed, rather scanty. *Medullary rays* fine, numerous.

Sub-Himalayan tract and Lower Himalayan valleys from the Salt Range to Bhutan, rising to 3000 ft.; Behar and Chota Nagpore; Central India and Marwar to Mount Abu.

The remarks made regarding *S. orientalis* apply almost equally to this species, which is especially noticeable as coming up in profusion on landslips and even among the stones and shingle of dry river-beds. The leaves are used to polish wood and horn, the bark gives a fair fibre and the branches are lopped for fodder. Growth very fast, 2 rings per inch of radius.

		lbs.
O 4664.	Dehra Dún (Gamble)	40
O 1369.	Gonda, Oudh (Wood)	36

5. **GIRONNIERA**, Gaud. Three species. *G. subæqualis*, Planch.; Fl. Br. Ind. v. 485; Bedd. Fl. Sylv. ccxix.; Trimen Fl. Ceyl. iv. 83 (*G. nervosa*, var. *subæqualis*, Kurz For. Fl. ii. 470); Vern. *Akmediya*, Cingh., is a rather large tree of Martaban and the Andaman Islands and also of the moist region of Ceylon (var. *ceylanica*, Thw.). *G. reticulata*, Thw.; Fl. Br. Ind. v. 486; Bedd. Fl. Sylv. t. 313; Gamble Darj. List

73; Trimen Fl. Ceyl. iv. 83 (*G. cuspidata*, Planch.; Kurz For. Fl. ii. 470); Vern. *Lali*, Nep.; *Wal-munamal*, Cingh., is a tree of the Sikkim Himalaya ascending to 3000 ft., Assam, the Khasia Hills, Burma ascending north to the Kachin Hills, the Western Ghâts from S. Kanara to Travancore and Ceylon. Beddome says the wood is hard and heavy and valuable for engineering; it is red-brown and used in Sikkim for planking, rafters, etc., being one of the rather numerous species called *Lali* (see *Machilus*, *Prunus*). *G. lucida*, Kurz For. Fl. ii. 470; Fl. Br. Ind. v. 486, is a tree of the Andaman Islands.

TRIBE III. MOREÆ.

6. PSEUDOSTREBLUS, Bureau. *P. indica*, Bureau; Fl. Br. Ind. v. 487, is a small tree found at the Borpani river at 4000 ft. in the Khasia Hills.

7. TAXOTROPHIS, Blume. *T. zeylanica*, Thw.; Fl. Br. Ind. v. 487; Bedd. Fl. Sylv. ccxxii.; Trimen Fl. Ceyl. iv. 100 (*Streblus zeylanica*, Kurz For. Fl. ii. 464), is a small evergreen tree or shrub of Burma and Ceylon.

8. PHYLLOCHLAMYS, Bureau. *P. spinosa*, Bureau; Fl. Br. Ind. v. 488; Brandis For. Fl. 411; Trimen Fl. Ceyl. iv. 101 (*Trophis spinosa*, Roxb. Fl. Ind. iii. 762, *Streblus taxoides*, Kurz For. Fl. ii. 465, *Taxotrophis Roxburghii*, Blume; Bedd. Fl. Sylv. ccxxi.); Vern. *Sukali*, Tel.; *Sheora*, Beng.; *Sahadra*, Uriya; *Kurrera*, Mar.; *Gongotu*, Cingh., is a small evergreen thorny tree of the moister forests of the Circars, Deccan and Carnatic, the swamp forests of Burma, the rocky coast of the Andaman Islands and the dry region of Ceylon.

9. STREBLUS, Lour.

Two species. *S. mitis*, Kurz For. Fl. ii. 464, is a tree of the Kakhyen Hills of Upper Burma.

1. S. asper, Lour.; Fl. Br. Ind. v. 489; Bedd. Fl. Sylv. ccxxi.; Brandis For. Fl. 410; Kurz For. Fl. ii. 464; Gamble Darj. List 74; Talbot Bomb. List 191; Trimen Fl. Ceyl. iv. 101. *Trophis aspera*, Retz; Roxb. Fl. Ind. iii. 761. Vern. *Jindi*, Pb.; *Siora*, *sihaura*, *karchanna*, *rúsa*, N.-W. P.; *Dahiá*, *kurchna*, Saharanpur; *Sheora*, Beng.; *Sahada*, *sahara*, Uriya; *Sahora*, Monghyr; *Hara saijung*, Kól; *Bamigi*, *barinka*, Koya; *Bumegi*, Reddi; *Baranki*, *barinika*, *pakki*, Tel.; *Patpiray*, *pirasu*, Tam.; *Poi*, *kharota*, *karvati*, *karera*, *kharaoli*, Mar.; *Karasni*, Gondi; *Mitli*, *punje*, Kan.; *Ungnai*, Magh; *Onhnè*, Burm.; *Geta netúl*, Cingh.

A small evergreen tree. *Bark* $\frac{1}{3}$ in. thick, soft, light grey, irregularly ribbed. *Wood* white, moderately hard, no heartwood, no annual rings. *Pores* small, in irregular concentric belts of soft tissue which contain the greater number of the pores and alternate with broader belts of firm tissue, in which a few pores are scattered. *Medullary rays* fine to moderately broad, not very numerous, equidistant.

Sub-Himalayan tract from the Beas eastwards; Bengal; Central, Western and Southern India; Burma and the Andaman Islands; Ceylon.

This small tree is chiefly found along river-banks and in hedges, also near villages in the drier regions of India. It has much the appearance of a *Ficus*, and the wood resembles also that of some of the figs. The wood, however, is useful, tough and elastic; it is said by Beddome to be sometimes used for cart-wheels (probably for "*wada*" carts) in South India. Graham Anderson says that it is difficult to cut, blunting the axes; he also notes the use of the sap as a rennet to curdle milk. The bark is used for paper-making in Siam (Kew Bulletin, 1888); and the twigs for toothbrushes. The rough leaves are used to polish wood and ivory. The fruit is edible, and the sap used in native medicine. Skinner, No. 66, gives W = 45 lbs. and P = 604; Kyd gives W = 42 to 75 lbs., P = 570: the average weight of the wood is probably 40 lbs. The tree is usually much twisted, and can be used for hedges, it coppices well, and is said to give a fair firewood. In Siam the bark is much used in the manufacture of paper (see Kew Bulletin, Addl. Series, ii., p. 46).

		lbs.
O 1478.	Gonda, Oudh (Wood)	40
C 1165.	Ahiri Reserve, C.P. (R. Thompson)	39
C 3577.	Khurdha Forests, Orissa (Gamble)	—
D 4333.	Kondavid, Kistna "	—

Nordlinger's Sections, vol. 10.

10. BROUSSONETIA, Vent.

1. B. papyrifera, Vent.; Fl. Br. Ind. v. 490; Brandis For. Fl. 410; Kurz For. Fl. ii. 467. The Paper Mulberry. Vern. *Malaing, thale*, Burm.

A small tree. *Bark* grey, smooth, with longitudinal striations. *Wood* soft: sapwood greyish-white; heartwood light brown. *Annual rings* very broad, autumn zone harder than the rest of the ring. *Pores* large in spring wood, often subdivided either longitudinally or transversely; in the rest of the wood gradually smaller and more scanty. *Medullary rays* moderately broad, short, rather numerous, wavy, giving a satiny silver-grain on a radial section.

Hills of Upper Burma and Martaban (Kurz); on the Salween river near Kolodo and Dahguinzeik at the borders of the Karennee country (Brandis): often cultivated, as at Dehra Dún. It extends to Siam, China, Japan, etc.

The inner fibre of the bark of this tree is used in Japan to make paper; in the South Sea Islands it is used to make "*Tapa*" cloth; in Siam and Burma it is made into the thick blackened cardboards known as "palabeiks," which are used like slates in Europe for writing on. It is an excellent paper fibre, though the stock is a little difficult to prepare of good colour (see Craddock in "Ind. For." xxvi. 613).

Brandis says, "This useful tree seems to accommodate itself readily to different 'conditions of climate, and might advantageously be cultivated in North-West India." Since that was written, experiments in its cultivation have been made at Dehra Dún: *first*, near Phandonwála, where it was tried on jungle-land of poor quality, and did not succeed, probably because it became choked by the heavy growth of big grasses; *secondly*, in the Kaunli garden, where it was such a success that it may be found almost impossible to eradicate it, if its eradication is necessary. It produces suckers in profusion, and grows luxuriantly from coppice, the growth being exceedingly fast. The Calcutta specimen here described had rings about one per inch, and the Dehra Dún trees must have grown almost as fast. But it requires good moist soil, and will not thrive on poor land. The experiments at Dehrá Dun have amply proved its capability of growth on good soil which can be irrigated, but the locality is too far from the factories to make cultivation on a large scale pay. On waste land near the coast in Bengal, Burma, Malabar and similar places, whence freight would be cheap, its cultivation might pay. Were there a paper factory at Dehra Dún or Saharanpur, near a good supply of bhabár grass and other paper materials, it would be possible to cultivate it on land unsuited for good timber like Sál, provided the land were well ploughed to begin with, and kept clear of grass and weeds till the crop was established. It could then be cut over on a short rotation of about 2 to 5 years, and give a large supply of paper stock and a certain amount of fair fuel. The growth is fast, the Kaunli garden specimen has some rings nearly an inch in breadth—average about 4 per inch of radius.

		lbs.
O 5065.	Kaunli, Dehra Dún (Babu Birbal)	30
C 4207.	Royal Bot. Garden, Calcutta (King)	18

Nordlinger's Sections, vol. 1 (*Morus papyrifera*).

11. ALLÆANTHUS, Thw. Two species. *A. zeylanicus*, Thw.; Fl. Br. Ind. v. 490; Bedd. Fl. Sylv. t. 305; Trimen Fl. Ceyl. iv. 103; Vern. *Alandu*, Cingh., is a tree of the moist region of Ceylon whose bark yields a tough fibre. *A. Kurzii*, Hook. f.; Fl. Br. Ind. v. 490 (*Malaisia tortuosa*, Kurz For. Fl. ii. 466), is a large deciduous scandent shrub of the forests of Burma.

12. PLECOSPERMUM, Trécul.

Two species. *P. andamanicum*, King; Fl. Br. Ind. v. 491, is a large unarmed shrub of the banks of the Attaran river in Tenasserim and of the Andaman Islands.

1. **P. spinosum,** Trécul; Fl. Br. Ind. v. 491; Bedd. Fl. Sylv. ccxx.; Brandis For. Fl. 401; Gamble Darj. List 74; Talbot Bomb. List 192; Trimen Fl. Ceyl. iv. 103. *Batis spinosa*, Roxb. Fl. Ind. iii. 762. Vern. *Mainakat-lara, maidal-lara*, Nep.; *Gumbengfong*, Mechi (?); *Koriti, alasale*, Tel.; *Bana-bana*, Uriya; *Katu-timbol*, Cingh.

A large thorny shrub. *Bark* thin, orange-coloured, peeling off in thin brittle flakes. *Wood* greyish-white, with a small bright orange-yellow heartwood, which is very hard. *Pores* from small to large, joined by wavy, more or less concentric, bands of soft and often interrupted tissue, which alternate with shining bands of firmer texture of about the same width. In the heartwood the pores are filled with a yellow resinous substance. *Medullary rays* fine and very fine, wavy.

Sub-Himalayan tract from the Salt Range eastwards; south to South India and Ceylon.

A common plant especially in open places and hedges near villages. Growth slow, 12 rings per inch of radius. Weight 50 lbs. per cubic foot. The wood is used in the Darjeeling Terai to give a yellow dye. The plant very closely resembles *Cudrania javanensis* in habit and foliage.

		lbs.
O 3134.	Dehra Dún	56
E 487.	Khookloong Forest, Darjeeling Terai (Manson)	45
E 2308.	Darjeeling Terai (Sir J. Edgar)	52
E 2448.	Tukdah Forest, Darjeeling, 5000 ft. (Gamble)	47

13. MORUS, Linn.

Four species. *M. atropurpurea*, Roxb. Fl. Ind. iii. 595; Fl. Br. Ind. v. 491, is a Chinese species allied to *M. alba*, and now cultivated in various parts of India. It has a long cylindric dark purple fruit.

Wood hard: sapwood usually white; heartwood yellow or yellowish-brown, turning darker on exposure. *Annual rings* of the species of colder climates marked by belts of large pores, in the rest of the wood pores gradually getting smaller, and arranged in more or less concentric groups. *Medullary rays* fine to moderately broad, often short.

1. **M. alba,** Linn.; Fl. Br. Ind. v. 492; Roxb. Fl. Ind. iii. 594; Brandis For. Fl. 407, t. 47. The White Mulberry. *Mûrier blanc*, Fr.; *Gelso bianco*, Ital. Vern. *Tút, túl, túlklu, chinni, chún*, Hind.; *Tútri, tuntri*, Dehra Dún.

A small or moderate-sized deciduous tree. *Bark* brown, rather rough. *Wood* hard: sapwood white; heartwood yellow or yellowish-brown, darkening on exposure. *Annual rings* marked by a conspicuous belt of moderate-sized and large pores, often subdivided, and usually in two or three rows, in the spring wood; *pores* in the rest of the wood scanty, getting gradually smaller outwards, more or less in concentric lines. *Medullary rays* fine to moderately broad, rather numerous, giving a pretty silver-grain.

Indigenous in Northern and Western Asia, cultivated in Northern India and up to 11,000 ft. in the Himalaya.

This is the chief mulberry used for silk production in the Punjab and Kashmir. The fruit is eaten; wild or semi-wild it is small and rather dry, but when properly

cultivated it has several very good varieties. The wood is good, weighs from 38 to 56 lbs. per cubic foot, and is used for building, boats, furniture and agricultural implements. This is the tree so much grown in the Dún along roadsides and at the Kaunli garden.

	lbs.
O 5064. Kaunli, Dehra Dún (Babu Birbal)	36 (young)
Nordlinger's Sections, vol. 1 (Tab. XIII. 4).	

2. M. indica, Linn.; Fl. Br. Ind. v. 492; Roxb. Fl. Ind. iii. 596; Brandis For. Fl. 408; Kurz For. Fl. ii. 468; Gamble Darj. List 74; Talbot Bomb. List 192. Indian Mulberry. Vern. *Túl*, Pb.; *Tútri*, Hind.; *Tút*, Kashmir; *Siahtút*, Kumaon; *Tút*, Beng.; *Chota kimbu*, Nep.; *Mekrap*, Lepcha; *Nuni*, *meshkuri*, Ass.; *Tút*, *ambat*, Mar.; *Poza*, Burm.

A moderate-sized deciduous tree. *Wood* hard, yellow, often with darker streaks, turning orange-brown on exposure; sapwood white. *Annual rings* distinctly marked by a belt of perhaps two or three rows of closely packed, moderate-sized and large pores which are generally subdivided. The *pores* in the outer portion of the annual ring are small, scattered, in small, somewhat concentric groups, uniformly distributed. *Medullary rays* moderately broad, short, giving a handsome silver-grain of shining narrow plates.

Lower Himalaya and sub-Himalayan tract from Kashmir to Sikkim, up to 7000 ft. in the North-West, to about 4000 ft. in Sikkim valleys; Shan Hills of Burma at 4000 ft.; cultivated elsewhere in Northern India and in the Nilgiris.

This is the tree cultivated in Bengal to feed silkworms, the trees being coppiced or pollarded to afford a plentiful supply of good leaves (see Roxb. Fl. Ind., also Cotes in Ind. Mus. Notes, vol. 1, and Watt Dict. Econ. Products, vol. vi. part iii.). The species of silkworm fed on the Mulberry are: (1) *Bombyx Mori*, Fabr., little used except in parts of the Punjab and at Dehra Dún; (2) *B. fortunatus*, Hutton, much reared in Bengal; (3) *B. Crœsi*, Hutton, also reared in Bengal and Assam; (4) *B. arracanensis*, Hutton, reared in Arracan and Burma; (5) *B. Textor*, Hutton, occasionally reared in Assam and Bengal; and *B. sinensis*, Hutton, sometimes also reared in Bengal.

The timber is of good quality, but not usually obtainable of any size, though at Changa-Manga a tree has been measured giving 5 ft. 11 in. girth at fifteen years of age. The growth is clearly very fast, usually under 5 rings per inch of radius. Reproduction is exceedingly easy; indeed, it is difficult to keep it down, and it is owing to this that it has almost succeeded in ousting the Sissu in the Changa-Manga and other plantations. The seed is chiefly spread by birds, notably by the rose-coloured starling, or "*Tillyer*" (*Pastor roseus*, Blyth): see Coventry in "Ind. For.," xxiv. 200. A fungus, likely to do considerable damage, found on the mulberry trees at Changa-Manga by F. Gleadow, is *Trichosporium aterrimum*, Massee.

	lbs.
P 891. Multán (Baden-Powell)	42
P 1195. Madhopur (F. Halsey)	47
P 5105 ♀, 5106 ♂, Changa-Manga Plantation, Punjab . .	37 and 45
Nordlinger's Sections, vol. 10.	

3. M. serrata, Roxb. Fl. Ind. iii. 596; Fl. Br. Ind. v. 492; Brandis For. Fl. 409. Vern. *Karún*, *tút*, *káura*, *túlúkúl*, *soá*, *án*, *shta*, *chimu*, *kimu*, Pb.; *Kimu*, *himu*, Hind.

A large deciduous tree. *Bark* greyish-brown, with a reddish tinge; usually rough, with shallow vertical fissures. Sapwood small, white; heartwood yellow or brown, with a slight lustre, moderately hard, darkening on exposure. *Annual rings* distinctly marked by a line or irregular belt of moderate-sized and large pores, which are frequently subdivided and filled with gum. In the outer portion of each annual ring the *pores* are small and moderate-sized, rather scanty, often arranged in more or less concentric short lines or groups. *Medullary rays* moderately broad, distant, giving a rather pretty silver-grain of narrow plates.

West Himalaya from Kumaon westwards, at 4–9000 ft.; often cultivated.

This is a large tree with large soft leaves and long catkins, easily recognized from *M. alba* and *M. indica*. It reaches a considerable size, and, as Brandis says, trees of 60 to 70 ft. high and 9 to 10 ft. in girth are not uncommon; while J. L. Stewart mentions several trees of 20 ft. in girth, and one at the Hindu temple of Barmaor in Chamba at 7000 ft., of 28 ft.

The wood is an excellent furniture wood, and is probably that which is most in use in the Himalaya, and is lately of considerable demand for making tennis and badminton bats at Sialkot. It is used for troughs, agricultural implements and cabinet-work, also for Simla carvings. The growth is sometimes fast, as fast as 4 rings per inch of radius, but more usually about 8 rings.

		lbs.
H 3174.	Dungagalli, Hazara, 7000 ft. (Wild)	—
H 10.	Julung, Simla, 4000 ft.	36
H 28.	Madhan, Simla, 5000 ft.	35
H 95.	Simla, 6000 ft.	36

4. M. lævigata, Wall.; Fl. Br. Ind. v. 492; Brandis For. Fl. 409; Kurz For. Fl. ii. 467; Gamble Darj. List 74. *M. cuspidata*, Wall.; Gamble Man. Ind. Timbers, Ed. i. 328. Vern. *Tút*. Hind.; *Kimbu*, Nep.; *Nambyong*, Lepcha; *Singtok, senta*, Bhutia; *Bola*, Ass.; *Malaing*, Burm.

A large tree. *Wood* yellow, with yellowish-brown heartwood, hard, close-grained, with a beautiful lustre, darkening on exposure to reddish-brown. *Annual rings* marked by a white line, and sometimes by a continuous string of pores. *Pores* rather scanty, uniformly distributed, moderate-sized to large, often oval and subdivided, each pore in a narrow ring of soft tissue, prominent on a vertical section. *Medullary rays* fine and moderately broad; the distance between the rays generally larger than the transverse diameter of the pores. Medullary rays prominent on a radial section, giving the wood a marked silver-grain.

Himalaya, from the Indus to Assam, up to 4000 ft., of very large size in the valleys of Sikkim; Shan Hills and hills of Martaban and Tenasserim in Burma; sometimes cultivated.

This fine tree reaches 100 ft. in height or more, with a girth of 15 ft. in the Eastern Himalaya; in the Western Himalaya it is apparently of smaller size. The wood is used in the Darjeeling Hills in house-building; in Assam for boat-oars and furniture. It deserves to be better known and to be more employed for furniture, cabinet-work, and perhaps tea-boxes. It has a long cylindric, rather dry and insipid fruit. The growth is moderate, averaging 7 rings per inch of radius. On an average W = 45 lbs. per cubic foot.

		lbs.
E 706.	Great Rangít Valley, Darjeeling, 3000 ft. (Manson)	42
E 3396.	,, ,, ,, 1000 ft. (Gamble)	44
E 656.	Bamunpokri, Darjeeling Terai (Manson)	48
E 2306.	Eastern Dúars, Assam (G. Mann)	47
E 2196.	Nowgong, Assam ,,	42
E 2305.	Kamrúp, Assam ,,	49

TRIBE IV. ARTOCARPEÆ.

14. FICUS, Linn.

This is probably the genus of woody plants of the Indian forests which contains the largest number of species. According to the Fl. Br. Ind., which follows the Monograph by Sir George King which was published in vol. 1 of the "Annals of the Royal Botanic Garden of Calcutta," there are 112 species in the area to which the Fl. Br. Ind. refers, and of these 82 occur in the region of British India, Burma and Ceylon taken up in this account. These 82 species belong to seven subgenera, and some of them are unimportant shrubs, climbers or small trees, which it is not necessary to specially mention. It is unnecessary to quote Sir G. King's Monograph, as his work is adopted in the Fl. Br. Ind.

The Fig genus contains some of the giants of the vegetable kingdom, the largest of which, such as the Banyan, Pipal and Indiarubber fig, are well-known Indian plants. From these gigantic plants, often covering large areas of ground by means of rooting drops from the branches, there is every gradation of size down to the small wiry-stemmed species which climb, ivy-like, over trees and rocks in moist valleys. Many of the figs are commonly epiphytic, or at any rate commence their lives as epiphytes, afterwards, having destroyed their hosts, becoming erect trees themselves. The wonderful arrangement by which the fertilization of the flowers of the figs, which are found in the interior of closed receptacles, is assisted by small Hymenopterous insects of the genus *Blastophaga*, need not here be described; for it is fully explained by Sir G. King.

The edible fig of Europe is *F. Carica*, Linn.; Brandis For. Fl. 418; Vern. *Anjir*. It is cultivated to some extent in India, and largely in Baluchistan, Afghanistan and Kashmir. For an account of the process of caprification see Brandis For. Fl. *l.c.* The big fig of Australia, whose leaves so much resemble those of the Indiarubber fig, *F. elastica*, is *F. macrophylla*, Desf.; Benth. Fl. Aust. vi. 170. It may frequently be seen in cultivation. The small climbing fig with large fruit and very polymorphous leaves so common on walls and trees in Calcutta, Dehra Dún and other places in India is *F. pumila*, Linn. It belongs to the section *Eusyce*.

Wood structure very uniform. *Wood* usually soft, characterized by alternate bands of soft and hard tissue, the breadth of either varying according to species and both conspicuous on a vertical section. *Pores* usually large, scanty, subdivided, irregularly scattered. *Medullary rays* usually of moderate breadth, sometimes of two classes, wavy.

SUBGENUS 1. PALÆOMORPHE.

Three species, usually small trees or epiphytic or scandent shrubs. *F. subulata*, Blume; Fl. Br. Ind. v. 497; Kurz For. Fl. ii. 452, is a straggling shrub of Chittagong and Burma; and *F. urophylla*, Wall., an erect shrub or small tree of Assam, the Khasia Hills, Chittagong and Burma.

1. **F. gibbosa**, Blume; Fl. Br. Ind. v. 496; Talbot Bomb. List 193. *F. parasitica*, Koen.; Bedd. Fl. Sylv. ccxxiv.; Brandis For. Fl. 420; Trimen Fl. Ceyl. iv. 85. *F. excelsa*, Vahl; Roxb. Fl. Ind. iii. 552; Kurz For. Fl. ii. 451. *F. Ampelos*, Koen.; Roxb. Fl. Ind. iii. 553. *F. tuberculata*, Roxb. Fl. Ind. iii. 554; Bedd. Fl. Sylv. ccxxiv. Vern. *Chhanchri*, Garhw.; *Dadu banda*, Dehra Dún; *Datir*, Mar.; *Tella barinka, konda juvi*, Tel.; *Baseri*, Khond; *Kaliporana*, Reddi; *Gas-nétul, wel-ehetu*, Cingh.; *Nyaungthabye*, Burm.

An epiphytic or erect tree. *Bark* thin, smooth, greenish-yellow. *Wood* light brown or grey, soft to moderately hard, divided into alternate broad hard dark, and narrow light soft more or less wavy concentric rings. The light rings occasionally anastomoze. *Pores* moderate-sized to large, scanty, irregularly distributed. *Medullary rays* moderately broad, light-coloured, rather short, not numerous.

Sub-Himalayan tract from the Jumna to Nepal; Bengal and Behar, Orissa and the Circars; throughout Central, Western and Southern India; Chittagong, Burma and the Andaman Islands; low country of Ceylon.

It is curious that King should write of this species as a "tree," and his statement is followed by the Fl. Br. Ind. Beddome also calls it a tree, Brandis a large tree or epiphyte, and the "Ceylon Flora" "an epiphyte in a young state, finally a tree." I have myself seen it growing in various parts of India, but never, that I can remember, as anything but a large epiphytic shrub, preferring to grow on other figs, such as the pipal and banyan, or on walls or well-sides, and giving out a multitude of interlacing aerial roots. Talbot seems to share my experience. It is, however, strange that Roxburgh, who lived long in the Circars, where it is common, writes of it as a tree, and mentions a beautiful specimen at Ganjam. Its broad rhomboid scabrous leaves are characteristic. The leaves are used to polish ivory (Roxb.), and are given to cattle, being supposed to increase the flow of milk.

		lbs.
C 3830.	Gullery Forest, Ganjam (Gamble)	33
C 4319.	Juddengy Forests, Godavari (Gamble)	—
W 4781.	Travancore (Bourdillon)	42

SUBGENUS 2. UROSTIGMA.

This subgenus contains 36 species, among them nearly all the largest and most important ones. They are generally epiphytic, at least in early life. *F. Dalhousiæ* Miq.; Fl. Br. Ind. v. 499, is a tree of the Nilgiris at 2–3000 ft. *F. mysorensis* Heyne; Fl. Br. Ind. v. 500; Bedd. Fl. Sylv. ccxxii.; Brandis For. Fl. 414; Kurz For. Fl. ii. 440; Gamble Darj. List 74; Talbot Bomb. List 193; Trimen Fl. Ceyl. iv. 86 Vern. *Sunkong*, Lepcha; *Goni*, Kan.; *Bhurvar*, Mar.; *Bunuga*, Cingh., is a large evergreen, sometimes epiphytic, shady tree of the Sikkim lower hills up to 3000 ft. Assam, the Khasia Hills, the Eng forests of Burma, the Western Ghâts and Ceylon a good tree to shade coffee. *F. pilosa*, Reinw.; Fl. Br. Ind. v. 500; Kurz For. Fl. ii. 441, is a large tree of Upper Tenasserim. *F. altissima*, Blume; Fl. Br. Ind. v. 504 Kurz For. Fl. ii. 442; Gamble Darj. List 74; Trimen Fl. Ceyl. iv. 87 (*F. laccifera* Roxb. Fl. Ind. iii. 545; Bedd. Fl. Sylv. ccxxiii.; Brandis For. Fl. 418; Kurz For. Fl. ii. 441); Vern. *Yokdúng*, Lepcha; *Práb, phegran*, Gáro; *Bur*, Ass.; *Kathal, bat* Sylhet; *Nyaungben*, Burm.; *Nuga, kosgona*, Cingh., is a very large, often epiphytic tree of the forests of the eastern Lower Himalaya from Nepal to Bhutan, Assam Eastern Bengal, Burma, the Andaman Islands, Malabar and Ceylon. It yields an indiarubber of quality less valuable than that of *F. elastica*. *F. Hookeri*, Miq.; Fl. Br. Ind. v. 505; Gamble Darj. List 74, is a scarce tree of the Sikkim Himalaya and Khasia Hills, up to 6000 ft., with broad leaves. *F. indica*, Linn.; Fl. Br. Ind. v. 506; Brandis For. Fl. 415; Kurz For. Fl. ii. 442, is a large spreading tree, rather scarce in the forests of Burma. *F. obtusifolia*, Roxb. Fl. Ind. iii. 546; Kurz For. Fl. ii. 443; Gamble Darj. List 74; Vern. *Krapchi*, Mechi; *Daté*, Magh; *Nyaunggyat*, Burm., is a small-leaved, epiphytic, but afterwards large tree of the Eastern sub-Himalayan region, Assam, Eastern Bengal and Burma, which yields an inferior kind of indiarubber. *F. Trimeni*, King; Fl. Br. Ind. v. 509; Trimen Fl. Ceyl. iv. 88, is a very large tree of Travancore and Ceylon. The huge specimen of it opposite the Herbarium at the Peradeniya Garden is well known. *F. Talboti*, King; Fl. Br. Ind. v. 312; Talbot Bomb. List 194, is a large tree common in the moist forests on the Southern Ghâts of North Kanara. *F. nervosa*, Roth; Fl. Br. Ind. v. 512; Bedd. Fl. Sylv. ccxxiii.; Kurz For. Fl. ii. 453; Talbot Bomb. List 194; Trimen Fl. Ceyl. iv. 89; Vern. *Nyaungpeinnè*, Burm.; *Kalumaduwa*, Cingh., is a tree of the eastern Lower Himalaya, Assam, the Khasia Hills, Chittagong, Burma, the Western Coast and Western Ghâts and Ceylon. *F. Arnottiana*, Miq.; Fl. Br. Ind. v. 513; Talbot Bomb. List 194; Trimen Fl. Ceyl. iv. 90; Vern. *Pacer*, Mar.; *Kaputobo*, Cingh., is a glabrous tree resembling the Pipal and found chiefly epiphytic on other trees and on rocks in the Deccan, extending to Chota Nagpore. It has recently also been found in the Tons Valley, Jaunsar Himalaya, at 3000 ft. *F. geniculata*, Kurz For. Fl. ii. 447; Fl. Br. Ind. v. 516; Vern. *Nyaungthabye*, Burm., is a large tree of the Sikkim Himalaya, Assam, Chittagong and Burma. *F. Rama Varmæ*, Bourdillon in Journ. Bomb. Nat. Hist. Soc. xiii. 155, is a very large species resembling the Banyan, but without aerial roots, recently discovered in evergreen forest in the hills of Travancore at 1–4000 ft.

2. **F. bengalensis**, Linn.; Fl. Br. Ind. v. 499; Bedd. Fl. Sylv. ccxxii.; Brandis For. Fl. 412; Kurz For. Fl. ii. 440; Gamble Darj. List 74; Talbot Bomb. List 193; Trimen Fl. Ceyl. iv. 86. *F. indica*, Roxb. Fl. Ind. iii. 539. The Banyan. Vern. *Bor, bar, ber, bargat*, Hind.; *Badu*, Kumaon; *Bur, but*, Beng.; *Boru*, Uriya; *Borhar*, Nep.; *Kangji*, Lepcha; *Ranket*, Gáro; *Bot*, Ass.; *Barelli*, Gondi; *Wóra, wada*, Kurku; *Bai*, Kól; *Ala*, Tam.; *Mári, peddi-mari*, Tel.; *Ahlada, aladamara, ala*, Kan.; *Peralu*, Mal.; *War, vada, vadi*, Mar.; *Cherla*, Mal.; *Maha-núga*, Cingh.; *Pyinyaung*, Burm.

A large or very large tree, throwing down numerous aerial roots from the branches. *Bark* ½ in. thick, greyish-white, smooth, exfoliating in small irregular plates. *Wood* grey, moderately hard, no heartwood, having narrow, wavy, concentric bands of soft tissue alternating with broader bands of firmer tissue and darker colour. *Pores* moderate-sized and large, sometimes very large, often subdivided, scanty, scattered irregularly. *Medullary rays* fine, equidistant, clearly marked, but not numerous. On a radial section the

pores and soft bands are distinctly marked, giving the wood a characteristic grain, the larger pores being frequently oblique.

Sub-Himalayan forests from Peshawar to Assam; deciduous forests of Behar, Chota Nagpore, Orissa, Circars, C.P., Bombay Presidency and South India; also, but less common, in evergreen forests; low country of Ceylon. It is, undoubtedly, "wild" in most of this area, but whether it is really "indigenous" it is difficult to say. The Fl. Br. Ind. says it is only wild (presumably "indigenous" is meant) in the sub-Himalayan forests and the lower slopes of the Deccan Hills, but it may be found far from villages in many other forest regions.

The rate of growth is not distinguishable by means of annual rings, but it is known that it is very fast. The tree sends down aerial roots from the branches, these root in the ground and grow into separate trunks, which serve as supports for the branches and as feeders for the tree, which thus largely increases in spread of foliage. Roxburgh states that he saw some trees with fully 500 yards' circumference round the spread of branches and about 100 ft. high. Brandis says that many specimens may be seen in Bengal with the crown 200 to 300 ft. in diameter. In Bengal, the aerial roots and long branches are usually more developed than in Northern India, but the trunk in the latter drier region attains a larger girth, often 25 to 30 ft. In the forest it does not seem to spread so widely as in the open or as the India-rubber Fig (*F. elastica*) does. Roxburgh says the largest trees are to be found about the villages situated in fertile valleys among the mountains. Balfour says that Marsden mentions a tree near Patna having a diameter of 363 to 375 ft. of spread, circumference of shadow 1116 ft., with 50 to 60 principal stems. The well-known tree in the Botanic Garden, Calcutta, which was ascertained by Falconer to have grown in 1782 from a seed deposited in the crown of a date palm, and which is consequently now 120 years old, measured when examined by Falconer in 1834, Hooker in 1847, and Balfour in 1863, 300 ft. in diameter of spread and 80 ft. in height. It has since suffered severely in the cyclones of 1864 and 1867, but has more or less recovered and was in 1900 of very large size. In 1886 its spread had a circumference of 857 ft. and its bole a girth of 42 ft. In November, 1900, so Dr. Prain informs me, its dimensions are: Longest diameters, N.-S. 288 ft., E.-W. 300 ft.; circumference of trunk 51 ft., of crown 938 ft.; height 85 ft.; number of rooted drops 464. Brandis met with a tree at Chicholi in Hoshungabad District, Central Provinces, 85 ft. high with a diameter of 275 ft., and occupying an area of 1½ acres. Its aerial roots were not, as usual in cultivation, assisted by bamboos, but small mounds of earth were heaped up to meet and receive them. A tree at Madura, measured in 1888 by Sir Philip Hutchins, had a spread of 200 ft. in diameter and a central bole 30 ft. in diameter. It occupied about three-fourths of an acre of ground. C. G. Rogers, in "Ind. Forester," vol. xxi. p. 95, describes a tree at Haidarpur Hinduwála in the Saharanpur District which had a circumference of spread of 523 ft. corresponding to 166 ft. diameter. Its height was only 53 ft. and the central bole had a girth of only 28 ft., but it had 127 distinct aerial roots. It must be remembered how far north and in how comparatively dry a climate this specimen is living. Mr. Warner, quoted by Sir G. King, describes a banyan at Wysatgarh near Satara which had, in 1882, a circumference of spread of 1587 ft.; while another, in the Andhra Valley near Poona, had a circumference of spread of about 2000 ft.

The name "Banyan" was, according to Yule and Burnell in "Glossary of Anglo-Indian Words," p. 50, given to a tree growing near the Gombroon (*i.e.* Bandar Abbas in the Persian Gulf), under which some banians or Hindu traders had built a pagoda. It is a sacred tree, and Hindus object to cutting it, hence the difficulty in obtaining labour in the forests to cut the banyans and other big figs which occupy large areas of ground to little purpose, and produce seed to propagate their kind. Cutting the banyan and other fig trees in the forest is, however, an important sylvicultural operation wherever it can be managed, and it is one which should be done, as far as prejudices will permit, systematically, as the trees not only occupy a great deal of land, but produce seed largely and form fresh plants.

The wood is esteemed of little value, but is durable under water, and therefore used for well-curbs. If carefully cut and seasoned it has a pretty grain and good texture, and can be made into furniture. It is sometimes used for boxes and door-panels. The average weight of the wood is about 36 lbs. per cubic foot; Skinner (No. 170) gives 36 lbs. and P = 600. The wood of the drops is stronger, and is used for tent-poles, cart-yokes and banghy-poles. The bark and small root-drops give a coarse fibre for rope-making. The milky juice is made into birdlime, the leaves are

used as plates, and the fibre is used for slow-matches by the Sikhs. Lac is sometimes collected on it, the leaves are used to cure bruises, the bark in native medicine, and the fruit is sometimes eaten. It is a common avenue tree, and being evergreen, fast-growing and easily propagated by large cuttings, is very useful for planting on road-sides. Cuttings, 8 to 10 ft. long, planted in July, succeed well. But although easily grown from cuttings, its propagation is effected naturally in most cases by means of the seeds. Birds are fond of the fruit, and the seeds pass through them and are ejected on the branches of other trees in their droppings. The seeds then germinate, and the roots are gradually pushed downwards along the branches and stem until they reach the ground where they can root, and the fig then grows and eventually envelops and kills its host. To buildings also of all kinds the banyan is most destructive, as the seedlings once rooted in crevices or cracks are almost impossible to extirpate. The leaves are rarely, if ever, eaten by goats, but, on the other hand, they are largely cut and used as elephant-fodder.

		lbs.
C 1150.	Ahiri Reserve, C.P. (R. Thompson)	38
C 836.	Bairagarh Reserve, Berar (Drysdale)	39
C 2813.	Melghát, Berar (Brandis)	—
D 4009.	Cuddapah (Gamble)	29
D 4132.	Madras	37
	Nordlinger's Sections, vol. 11.	

3. **F. tomentosa**, Roxb. Fl. Ind. iii. 550; Fl. Br. Ind. v. 501; Bedd. Fl. Sylv. ccxxiii.; Brandis For. Fl. 414; Talbot Bomb. List 194; Trimen Fl. Ceyl. iv. 87. Vern. *Petta mari*, Tel.; *Wel-aralu*, Cingh.

A large tree, usually epiphytic. *Bark* greenish-white, ¼ in. thick, smooth. *Wood* moderately hard, white, with alternate bands of soft pale and firm dark tissue, very regular and concentric. *Pores* moderate-sized to large, very scanty, often subdivided. *Medullary rays* fine, prominent, equidistant.

Dry regions of India, Bandelkhand, Behar, Chota Nagpore, southwards to the Deccan forests, westwards to the coast of the Konkan and Kanara; dry region of Ceylon.

A pretty species with few aerial roots. It is fond of old buildings and does much damage to them.

		lbs.
C 3646.	Daltonganj, Palamow (Gamble)	41

4. **F. glaberrima**, Bl.; Fl. Br. Ind. v. 506; Gamble Darj. List 74. *F. Thomsoni*, Miq.; Kurz For. Fl. ii. 443. *F. angustifolia*, Roxb. Fl. Ind. iii. 554. Vern. *Kakhri*, *khankri*, *durlá*, Hind.

An evergreen tree. *Bark* ½ in. thick, light yellowish-brown, slightly wrinkled and lenticellate, otherwise smooth. *Wood* soft, with alternate concentric bands of soft and close tissue. *Pores* large, often subdivided, scanty, unevenly distributed. *Medullary rays* fine, rather distant.

Sub-Himalayan tract from the Jumna eastwards, in wet places in Dehra Dún, Kumaon, etc.; Burma and the Andaman Islands.

		lbs.
O 5094.	Dehra Dún (Babu U. N. Kanjilal)	35

5. **F. Benjamina**, Linn.; Fl. Br. Ind. v. 508; Bedd. Fl. Sylv. ccxxiii.; Brandis For. Fl. 417; Kurz For. Fl. ii. 446; Talbot Bomb. List 194. *F. nuda*, Miq.; Kurz For. Fl. ii. 445. Vern. *Waringin*, Malay.

A very large tree, with drooping branches. *Wood* soft, light brown, in alternate layers of light brown soft tissue and darker (lighter on a vertical section) hard tissue, the breadth of the soft layers about half that of the hard ones. *Pores* moderate-sized to large, very scanty, unevenly distributed. *Medullary rays* fine to moderately broad, rather numerous, uniform.

Indigenous in Timor, Sumatra and Celebes, planted elsewhere (King).

A very fine avenue tree and excellent for shade; huge specimens are common in Java.

Nordlinger's Sections, vol. 4 (young tree only) (Tab. XIII. 5).

Var. *comosa*, Kurz For. Fl. ii. 446; Gamble Darj. List 74. *F. comosa*, Roxb. Fl. Ind. iii. 552. Vern. *Kabra*, Nep.; *Kunhip*, Lepcha; *Juri pakri*, Ass.; *Putra jivi*, Tel.; *Sunomjar*, Sonthal; *Jili*, Mal Pahari.

A moderate-sized, evergreen, often epiphytic tree. *Bark* thin, smooth, grey. *Wood* grey, moderately hard, with alternating concentric bands of soft and hard tissue. *Pores* large, scanty, often subdivided. *Medullary rays* fine, numerous.

Eastern Himalayan valleys and sub-Himalayan tract; Assam, Eastern Bengal and Chittagong; throughout Burma; Behar, Chota Nagpore and the Circars.

This variety is at once recognized by its large yellow fruit, the type having a small fruit only. In respect to leaves the two are almost identical.

		lbs.
E 588.	Bamunpokri, Darjeeling (Manson)	34

No. D 3971 from the Agri-Hortl. Gardens, Madras, called *F. javanica*, is probably the "*Waringin*" *F. Benjamina*.

6. **F. elastica**, Roxb. Fl. Ind. iii. 541; Fl. Br. Ind. v. 508; Brandis For. Fl. 417; Kurz For. Fl. ii. 444; Gamble Darj. List 75. The Indiarubber Fig or Caoutchouc tree. Vern. *Bor*, *attah bor*, Beng., Ass.; *Lesu*, Nep.; *Yok*, Lepcha; *Ranket*, Gáro; *Kagiri*, *kasmir*, Khasia; *Bawdi*, *nyaungbawdi*, *nyaungkyetpaung*, *kyetpaungbin*, Burm.

A gigantic evergreen tree, sending down numerous aerial roots from the branches. *Bark* reddish-brown, smooth but scurfy, in open places it is sometimes grey. *Wood* soft, light brown, with alternate concentric bands of soft dark and ordinary tissue. *Pores* moderate-sized to large, scanty, unevenly distributed. *Medullary rays* fine to moderately broad, wavy, unequally distributed.

Outer hills of the Eastern Himalaya from Nepal eastwards, rising to 3000 ft.; Assam, Khasia Hills; Hukong and other valleys of Upper Burma up to 5000 ft.; often cultivated.

The indiarubber tree is usually epiphytic, the seeds germinating at the summit of tall forest trees, where the seedlings can get light. It is often of very great height, trees 100 to 120 ft. high being not unusual. H. N. Thompson, in his "Report on the Hukong Valley, etc.," gives 150 to 200 ft. and a girth round the outside of the aerial roots of 100 to 130 ft. for very big trees which tower over the tops of the trees of the ordinary forest. It sends down innumerable aerial roots which have a reddish-brown bark, peeling off in small thin narrow strips or flakes; and these roots often extend considerable distances, giving a great spread to the tree. In Brandis' "Forest Flora" the measurements of a tree described by Griffith (1838) are given; these are—

Height	100 ft.
Circumference of main trunk	74 „
„ of supports	120 „
„ of area covered by the branches .	610 „

Mann, in his report of 1875, gives the following measurements for a tree at Tezpur aged 32 years, and having over 100 aerial roots:—

Height	110 ft.
Diameter of crown	140 „
Circumference of stem with central supports .	70 „

The tree is tapped by means of slanting notches about 12 in. apart, made in the stem, aerial roots and roots. The milk is allowed to collect and coagulate in these notches for two or three days, after which time the hard indiarubber in each notch is easily collected by being pulled out in a strip. The tree will not bear yearly tapping, once in three years is as much as it will stand; if tapped yearly, it is liable to die off,

as did many of the trees in Darjeeling after heavy tapping in 1871, 1872 and 1873. Those which then survived had not recovered sufficiently for retapping by 1880, and I have not heard of their having been tapped since then.

The tree is easily propagated from seed in small beds thatched over and fenced round to keep out the sun, and provided with small trenches filled with water. By these means a constant hot moist atmosphere is secured and seedlings do well, but the soil should be good and contain plenty of "humus." For an interesting account of rearing India-rubber plants from seed at Dehra Dún, see "Ind. Forester," vol. xxv. p. 63 for an article by Babu Birbal and Babu Upendranath Kanjilal.

The following extracts from reports by Mr. Mann and Dr. Schlich will explain in more detail the systems used in Assam and Bengal. Mr. Mann says:—

"To give the raising of rubber plants from seed a fair trial, about 30 seers of seed, 'or rather fruit, were collected and sown in three different ways both at the Kulsi 'plantation in the Gauhati subdivision and the Charduar plantation in the Tezpur 'subdivision. The different modes used were the following:—

"First, on beds covered with broken bricks, half of which was sown with entire 'fruit of figs, and the other half with the fruit broken up or rubbed into powder between 'the hands.

"Secondly, sown like the above, but on broken charcoal.

"Thirdly, sown like the above, but on earth only.

"The seed was sown in the middle of January, and germinated in the middle of 'April. Germination took place best on the broken bricks, next best on the charcoal 'and least on the earth. The seedlings on the charcoal stood the heavy rains best, those 'on the broken bricks next, whilst those on the soil nearly all perished. They require 'no shading, and grow all the stronger by exposure to the light and sun; but as a 'matter of course they will require a great deal more care and attention than cuttings, 'and for several years, whilst cuttings can be transplanted before they are a year old.

"The artificial shading over these seed-beds caused drip and excessive moisture, 'which proved fatal to many of the seedlings before the cause of the mischief was 'recognized.

"The number saved amounted, however, to about 1200, which were on an average 'of the undermentioned sizes as they grew:—

On the 27th June 1874	$\frac{9}{10}$ in.
„ 12th August 1874	$1\frac{2}{10}$ „
„ 10th September 1874	$5\frac{7}{10}$ „

And Dr. Schlich says, "At Bamunpokri nine nursery beds were prepared, three 'with common garden soil, three with broken bricks, and three with charcoal, and all 'intersected by irrigation trenches, thus keeping the soil thoroughly moist by percolation. 'The seed was collected in September 1874, and sown in that month and in October 'partly in whole figs, and partly crumbled up by the hand. The beds were then 'shaded by thatch, raised 2 ft. above the ground on the south, and 3 ft. on the north, 'and the sides were closed in with mats which could be removed at will.

"From four to six weeks after sowing the seeds germinated profusely, best of all 'in the garden soil, next best on the broken bricks, and last, though still pretty well, 'on the charcoal; they have thriven well, and are now up to 5 in. high, with leaves up 'to 2 in. long." In 1880 they were 15 to 20 ft. high.

The propagation by cuttings is still easier, but the cuttings must be from young fleshy shoots, such as are obtained by pollarding several branches of an old tree and allowing them to send out shoots. In Sikkim and Assam, plants grown from seedlings or cuttings have succeeded either planted directly in the ground or in baskets of mould tied to the upper branches of trees. In Assam, plantations are formed by cutting lines at some distance apart through the forests, and planting the rooted cuttings or seedlings at intervals. The following extracts from Mr. Mann's Memorandum of 1875 will best explain the method of plantation:—

"The method of planting adopted in the Kulsi caoutchouc plantation is the 'following:—

"Lines 20 ft. in width and 50 ft. apart are opened out in mixed plain and savannah 'forest, and the trees are planted out on these lines at distances of 25 ft.

"The plants were examined by me on the 26th of April, and the countings showed '2 per cent. of failures, which were filled up the same day. Nothing could surpass the 'healthiness and vigour of the young trees, whose only enemies are the deer, which has 'made fencing necessary; but the plants will soon have grown beyond the reach of them.

"The method of planting adopted in the Charduar plantation was the following:—

"Lines of 20 ft. in width and 100 ft. apart were opened out through lower hill 'forest, and trees were planted out on these lines at distances of 50 ft. The width of 'lines proved insufficient as soon as the rains set in, and the excessive shade and drip 'from the trees on either side of the line proved injurious and in many cases fatal to the 'plants. The planting on split stumps of trees and in earthenware rings, placed with 'the widest opening on stumps, was suggested by the Chief Commissioner and proved 'very successful in low situations, counteracting the excessive wet on the ground; but 'vigorous growth was not ensured until more light was admitted. All the lines of last 'year's plantation were therefore opened to 40 ft. in width, and the effect on the young 'trees has already been most beneficial, so that, although it is only the commencement 'of the growing season, nothing could surpass the vigour and healthy appearance of the 'trees, and so far as the planting on lines opened out through the forest goes it cer-'tainly is a perfect success. The ground on these lines was not cleared except just 'around the plants, but the opening out of bridle-paths has become necessary to save 'time in going over the plants, since frequent inspection is the only way to prevent any 'vacancies remaining in the plantation."

From the Assam Forest Administration Report of 1897–98 it is gathered that the 88 acres planted at Kulsi in 1873–77 carried, in 1898, at 22 years old, 2411 trees, having an average height of 87 ft. 8 in., and average girth of central bole of 6½ ft., the girth of the biggest being 12¼ ft.; that 13 acres planted in 1878 had trees averaging: height 81 ft., girth 9 ft.; that 25½ acres planted in 1883 had trees averaging: height 67 ft., girth 5 ft.; and that 33¼ acres planted in 1884 had: height 55 ft., girth 4¼ ft.

At Charduar there were, in 1898, 1700 acres of plantation. The trees measured—

	Height. ft. in.	Girth. ft. in.
Plantation 23 years old	85 0	23 2
„ 22 „	83 8	20 9
„ 21 „	80 11	14 11
„ 20 „	78 5	13 9
„ 19 „	71 7	11 6
„ 18 „	70 10	13 3
„ 17 „	68 0	12 2

Experimental tappings made in 1896–97 and 1897–98 in Charduar plantation gave: for 21 trees, 46 and 48 lbs. of rubber respectively, *i.e.* 2·19 and 2·29 lbs. per tree. The rubber produced was valued at from 2*s.* 3*d.* to 2*s.* 9*d.* per lb. in England. A. L. Home, in "Ind. Forester," xxv. 70, estimates a yearly outturn of 8000 lbs. of rubber, valued at 2*s.* 8*d.* per lb., yielding a *gross* return of Rs.16,000 and a *net* return of Rs.10,400, which is equivalent to 9 per cent. interest on the capital cost of the plantations.

It is interesting to note the results obtained in Java in what is said to be the oldest indiarubber plantation in the world, that in the Kranong province, planted by a private proprietor. There are 72½ acres of plantation with 5200 trees. They were first tapped when the trees were 14 years old, in 1886, and up to 1895, after seven years' tappings, it was found that the plantation gave 71 lbs. per acre per annum, and a net money yield of £1 12*s.* 10*d.* per acre per annum since the establishment of the plantation (Berkhout, "Ind. Forester," vol. xxiv. p. 160).

The collection from wild trees in the natural forests is made by the hill tribes, who tap the trees and bring the rubber out in balls and sell it to traders in the plains. The balls have to be carefully examined in order to remove stones, mud, chips, pieces of bark and other similar adulterants.

	lbs.
E 2449. Chawa Jhora, Sivoke, Darjeeling Terai (Gamble)	43
Nordlinger's Sections, vol. 8 (young plant).	

7. **F. retusa,** Linn.; Fl. Br. Ind. v. 511; Bedd. Fl. Sylv. ccxxiii.; Brandis For. Fl. 417; Kurz For. Fl. ii. 444; Gamble Darj. List 75; Talbot Bomb. List 194; Trimen Fl. Ceyl. iv. 89. *F. Benjamina*, Willd.; Roxb. Fl. Ind. iii. 550. Vern. *Kamrup, jir, zir*, Beng.; *Totmida*, Garhwal; *Jamu, barri*, Nep.; *Sitnyok*, Lepcha; *Butisa*, Kôl; *Pefri*, Kurku; *Burdungi*, Khond; *Nandruk*, Mar.; *Pilála*, Kan.; *Yerra juvi*, Tel.; *Itti*, Tam.; *Panu-nuga*, Cingh.; *Nyaungôk*, Burm.

A large evergreen usually epiphytic tree. *Bark* brown, fairly smooth. *Wood* light reddish-grey, moderately hard, with narrow

wavy bands of soft tissue alternating with broader bands of firm texture. *Pores* moderate-sized, often subdivided, scanty. *Medullary rays* short, moderately broad.

Sub-Himalayan tract from Kumaon eastwards; Assam, Khasia Hills and Eastern Bengal; forests of the Sundarbans; common in Burma, the Coco Islands and the Andaman Islands; very common in Ceylon: often planted.

A handsome species, very suited for shady avenues. The wood is one of the best of the fig kind and might be used for furniture, but that all the fig woods are looked upon as useless. Prain says the fruit is one of the favourite foods of the large pigeon (*Carpophaga bicolor*) in the Coco Islands.

		lbs.
O 4487.	Forest School Garden, Dehra Dún	30
E 404.	Sundarbans (Richardson)	40
B 2278.	Andaman Islands (Col. Ford)	40
No. 45, Ceylon Collection, old (Mendis).		

8. F. Rumphii, Blume; Fl. Br. Ind. v. 512; Kurz For. Fl. ii. 448; Gamble Darj. List 75; Talbot Bomb. List 194. *F. cordifolia*, Roxb. Fl. Ind. iii. 548; Brandis For. Fl. 416, t. 48. Vern. *Rúmbal, palák, badha, pilkhan*, Pb.; *Kabar, gajiún, gajna, pipal, gagjaira, pakar, khabar*, Hind.; *Kabai pipal*, Kumaon; *Ganjher*, Oudh; *Pilkhoi*, Jaunsar; *Gai aswát*, Beng.; *Pakar*, Nep.; *Pakri*, Ass.; *Sat-bur*, Cachar; *Prab*, Gáro; *Parás pipal*, Ajmere; *Pair*, Mar.; *Nyaungbyu*, Burm.

A large deciduous, often epiphytic tree. *Bark* smooth, grey, ½ in. thick. *Wood* very soft, spongy, with alternating bands of loose and firm tissue of equal width. *Pores* oval, scanty, moderate-sized. *Medullary rays* fine, uniform, equidistant.

Outer Himalaya and sub-Himalayan tract from the Chenab eastwards ascending to 5000 ft.; Bengal, Orissa and the Circars; Central India and Burma.

A large forest species. The wood is used in Cachar for charcoal for tea manufacture. The tree is generally epiphytic, and is then very destructive to timber trees. In Assam the lac insect is reared on it (Mann). The fruit is eaten and the leaves and branches used for cattle-fodder and to feed elephants.

		lbs.
H 605.	Chitul Forest, Kangra (Pengelly)	27
P 3224.	Nagpahar, Ajmere	—

E 586, 20 lbs., sent from the Darjeeling Terai under the name of "*Niwaro*," and E 716, 27 lbs., sent from Chittagong under those of *Hijalya*, Beng.; *Choupaha*, Magh, resemble this species in structure.

9. F. religiosa, Linn.; Fl. Br. Ind. v. 513; Roxb. Fl. Ind. iii. 547; Bedd. Fl. Sylv. t. 314; Brandis For. Fl. 415; Kurz For. Fl. ii. 448; Gamble Darj. List 75; Talbot Bomb. List 194; Trimen Fl. Ceyl. iv. 90. The "Peepul" or "Pipal" tree. Vern. *Pipal*, Hind.; *Aswat, asúd*, Beng.; *Pipli*, Nep.; *Bor-bur*, Cachar; *Jari, usto*, Uriya; *Hesar*, Kól; *Pipali*, Khond; *Arasa*, Tam.; *Rái, raiga, ragi, ravi*, Tel.; *Ali*, Gondi; *Pipri*, Kurku; *Ashvatha*, Mar.; *Pipro*, Panch Mehals; *Rangi, arali, basri*, Kan.; *Nyaungbawdi*, Burm.

A large tree, usually epiphytic, but without aerial roots. *Bark* grey, nearly ½ in. thick, exfoliating in rounded irregular flakes of varying size, often leaving rounded depressions. *Wood* greyish-white, moderately hard; having narrow bands of soft tissue, which alternate with broader bands of firmer substance. *Pores* moderate-sized and large, often subdivided, rather scanty. *Medullary rays* uniform and equidistant, moderately broad.

Sub-Himalayan forests from the Punjab eastwards; Bengal, Orissa and the Circars; Central India; Upper Burma: planted and run wild in other parts of India, Burma and Ceylon.

The Pipal tree is one of the best-known of Indian trees, for it is commonly planted in villages and held sacred both by Hindus and Buddhists. The sacred "Bo" tree at Anuradhapura in Ceylon, which was brought from N. India and planted in 288 B.C., is probably the oldest, or nearly the oldest, tree in the world historically known (Emerson-

Tennant, "Ceylon," ii. 613). The sacred tree at Budh Gya, under which Gautama Buddha sat, is only now represented by a successor. By Hindus the killing of a Pipal tree is looked upon as a great sin, so that it is rarely felled, and though it is very destructive to forest trees it is difficult to get it cut. It is sometimes found growing on and enveloping the date-palm, as may be seen in the Saharanpur Botanic Garden. It is, however, largely lopped for cattle, elephant and camel fodder, chiefly by Muhammedan attendants. It does great damage to buildings, walls and wells, as when once rooted the seedlings are most difficult to extirpate. The leaves, bark and fruit are used in native medicine, and the bark gives a tenacious milky juice which hardens into a substance resembling *gutta-percha*. The tree is easily propagated by sowing the seeds, or by cuttings, even when quite large pieces are used. It is good for avenues.

The wood is used for packing-cases and for fuel, occasionally for charcoal. It has been found that 100 lbs. of steam-dry wood gave 5·48 lbs. of ash, of which 2·25 lbs. were phosphates of iron, calcium, etc., 1·96 lbs. calcium carbonate and 1·07 lbs. magnesium carbonate, the rest sodium, silica and other substances. The weight and transverse strength have been determined by the following experiments:—

		Weight.	P.
Cunningham at Gwalior in 1854, in two experiments with bars 2′ × 1″ × 1″	found	44	458
Skinner in Madras in 1862 (No. 72) . . .	„	34	584

On an average, the weight of the wood is about 35 lbs. per cubic foot.

The Pipal is one of the trees on which the Lac insect (*Carteria Lacca*, Kerr.) grows; and on it also is sometimes found the Chinese white wax insect, *Ceroplastes ceriferus*, Sign.

		lbs.
P 893.	Multán (Baden-Powell)	45
O 533, 538, 543.	Dehra Dún (O'Callaghan)	31, 31 and 23
C 1168.	Ahiri Reserve, Central Provinces (R. Thompson) . . .	44
C 837.	Bairagarh Reserve, Berar (Drysdale)	34
C 2814.	Melghát, Berar (Brandis)	—
D 4008.	Cuddapah	42
	Nordlinger's Sections, vol. 9.	

10. F. Tjakela, Burm.; Fl. Br. Ind. v. 514; Talbot Bomb. List 194; Trimen Fl. Ceyl. iv. 91. Vern. *Kiripella*, Cingh.

A large deciduous tree. *Wood* brown, soft, in alternate concentric rings of narrow dark loose tissue and broader pale firmer tissue, the dark layers very conspicuous on a vertical section. *Pores* large, very scanty, irregularly scattered. *Medullary rays* fine, dark, wavy, not numerous.

Forests of Western and Southern India, common on the Gháts of N. Kanara, in Mysore and the South Deccan; Ceylon: often planted to shade coffee.

	lbs.
No. 72, Ceylon Collection, new (Mendis)	30

11. F. Tsiela, Roxb. Fl. Ind. iii. 549; Fl. Br. Ind. v. 515; Bedd. Fl. Sylv. ccxxiii.; Brandis For. Fl. 415; Talbot Bomb. List 194; Trimen Fl. Ceyl. iv. 92. Vern. *Jadi*, Tel.; *Pipri*, Mar.; *Bili-basri*, Kan.; *Kalatti*, Tam.; *Ela nuga, ehetu*, Cingh.

A large tree without aerial roots. *Bark* greenish-grey, smooth. *Wood* grey, soft to moderately hard, with alternate bands of soft and hard tissue. *Pores* very scanty, large, conspicuous on a vertical section. *Medullary rays* fine, equidistant.

Forests of the Deccan, Western Gháts and Carnatic; often planted in avenues. A common avenue tree in the drier parts of the Madras Presidency.

		lbs.
D 4227.	Cuddapah (Higgens)	34

12. F. infectoria, Roxb. Fl. Ind. iii. 550; Fl. Br. Ind. v. 515; Bedd. Fl. Sylv. ccxxii.; Brandis For. Fl. 414; Kurz For. Fl. ii. 446; Gamble Darj. List 75; Talbot Bomb. List 195; Trimen Fl. Ceyl. iv. 92. *F. Wightiana*, Wall.; Bedd. Fl. Sylv. ccxxii.; Brandis For. Fl. 414. Vern. *War, var, batbar, jangli pipli, palákh, trimbal,*

Pb.; *Pilkhan, kahimmal, ramanjir, pákhar, pakri, keol, kaim, khabar,* Hind.; *Dúdhli, pilkhoi,* Jaunsar; *Kobra, pilkháru, pariya,* Garhwal; *Pákar,* Beng.; *Safed kabra,* Nep.; *Kangji,* Lepcha; *Prab,* Gáro; *Serilli,* Gondi; *Pepere,* Kurku; *Baswésa,* Kól; *Kundotkum,* Hyderabad; *Jovi, kall-alun,* Tam.; *Jewi, yuri,* Tel.; *Tsjakela,* Mal.; *Bassari, pakari, lendva,* Mar.; *Hari basri,* Kan.; *Nyaunggyin,* Burm.; *Kalaha,* Cingh.

A large, usually epiphytic, tree. *Bark* ½ in. thick, greenish-grey, smooth, exfoliating irregularly in flakes and patches. *Wood* grey, moderately hard; with narrow concentric bands of soft tissue alternating with broader bands of firm texture. *Pores* large, scanty, often subdivided. *Medullary rays* uniform, moderately broad, equidistant.

Sub-Himalayan tract and Lower Himalaya from the Salt Range to Sikkim; thence throughout India, Burma and Ceylon, more commonly planted than wild.

A widely spread species, in three varieties each of rather distinct appearance. The common variety has rather large leaves with acute bases and long petioles; var. *Lambertiana* has also large leaves with rather long petioles and cordate bases; while var. *Wightiana* has smaller leaves and is more common in South India in a wild state. The wood is sometimes used for charcoal, not otherwise. The young shoots are eaten in curries and the leaves make good elephant-fodder, while the bark gives a fair fibre.

		lbs.
P 911.	Salt Range, Punjab (Baden-Powell)	31
C 1166.	Ahiri Reserve, C.P. (R. Thompson)	37
C 838.	Bairagarh Reserve, Berar (Drysdale)	34
C 2808.	Melghát, Berar (Brandis)	—

13. **F. callosa**, Willd.; Fl. Br. Ind. v. 516; Kurz For. Fl. ii. 454; Talbot Bomb. List 195; Hook. Fl. Ceyl. iv. 93. *F. cinerascens*, Thw.; Bedd. Fl. Sylv. ccxxiv. Vern. *Wal-gona*, Cingh.

A large tree. *Wood* white or greyish-brown, soft, in alternate layers of narrow loose tissue and broader firm tissue. *Pores* large, much subdivided, irregular, fairly numerous. *Medullary rays* moderately broad, not very numerous.

Evergreen forests of the Western Gháts, from the Konkan southwards; tropical forests of Burma and the Andaman Islands; Ceylon.

Nos. 40, 146, Ceylon Collection, new (Mendis).

Subgenus 3. SYNŒCIA.

Only one species. *F. callicarpa*, Miq.; Fl. Br. Ind. v. 518 (*F. pomifera*, Kurz For. Fl. ii. 454), is an evergreen climbing or creeping shrub of Upper Tenasserim, with large receptacles.

Subgenus 4. SYCIDIUM.

Ten species, mostly shrubs, climbers or small trees, rarely epiphytal, often with rough leaves. *F. heterophylla*, Linn. f.; Fl. Br. Ind. v. 518; Roxb. Fl. Ind. iii. 532; Brandis For. Fl. 424; Kurz For. Fl. ii. 456; Talbot Bomb. List 195; Trimen Fl. Ceyl. iv. 93; Vern. *Datir*, Mar.; *Ghoti-suara*, Beng.; *Buroni*, Tel.; *Wal-ehetu*, Cingh., is a polymorphous rough-leaved shrub, common near streams in most hot parts of India, Burma and Ceylon. *F. sikkimensis*, Miq.; Fl. Br. Ind. v. 521; Gamble Darj. List 75; Vern. *Lekbilani*, Nep., is a small tree of the lower part of the Sikkim Himalaya and Khasia Hills, at 2–4000 ft., with very small figs. *F. obscura*, Blume; Fl. Br. Ind. v. 521; Gamble Darj. List 75; Vern. *Kasirut*, Nep.; *Tuksot*, Lepcha, is a shrub, also of the lower Sikkim Himalaya and the Khashia Hills and extending to Burma, with very rough leaves and a bark which is used to make rough forest ropes.

14. **F. clavata**, Wall.; Fl. Br. Ind. v. 520; Gamble Darj. List 75. *F. trachycarpa*, Miq.; Brandis For. Fl. 421. Vern., *Khanoi, sansoi*, Jaunsar; *Giruli*, Nep.; *Siratpé*, Lepcha.

A shrub, with small narrow rough leaves. *Bark* thin, smooth,

greenish-grey. *Wood* white, moderately hard, close-grained, with very regular alternate layers of white soft and firmer dark tissue. *Pores* moderate-sized, scanty, often subdivided and enclosed in a ring of loose tissue. *Medullary rays* pale, fine to moderately broad, very short.

Lower Himalaya from the Sutlej eastwards, ascending to 4500 ft.; the Khasia Hills and hills of Burma.

E 3612. Chenga Forest, Darjeeling, 1500 ft. (Gamble).

15. F. asperrima, Roxb. Fl. Ind. iii. 554; Fl. Br. Ind. v. 522; Bedd. Fl. Sylv. ccxxiv.; Talbot Bomb. List 195; Trimen Fl. Ceyl. iv. 94. Vern. *Kharwat*, Mar.; *Khargas*, Kan.; *Irumbarutthan*, Tam.; *Gergutti*, Kan.; *Theragam*, Mal.; *Sewana-médiya*, Cingh.

A shrub or small tree. *Wood* white, soft, with regular wavy concentric but often anastomozing bands of alternate pale loose tissue and darker hard tissue. *Pores* large, usually subdivided into 2 or 3 partitions, scanty. *Medullary rays* moderately broad, not numerous.

Central, Western and Southern India, also Ceylon, in hill ranges at about 3000 ft.

The leaves are very rough, and used as sandpaper, especially for sandalwood carvings. Bourdillon gives W = 24 lbs., P = 245.

		lbs.
W 4675.	Travancore (Bourdillon)	23

SUBGENUS 5. COVELLIA.

Eight species, shrubs or trees, not epiphytes or climbers. *F. conglobata*, King; Fl. Br. Ind. v. 522; Gamble Darj. List 75; Vern. *Tuksot*, Lepcha, is a small tree of the Lower Sikkim Himalaya and Chittagong. *F. sæmocarpa*, Miq.; Fl. Br. Ind. v. 523; Gamble Darj. List 76 (*F. tuberculata*, Wall.; Brandis For. Fl. 424, *F. pyrrhocarpa*, Kurz For. Fl. ii. 457, *F. squamosa*, Roxb. and *F. laminosa*, Hardw.; Roxb. Fl. Ind. iii. 531); Vern. *Chancheri*, Garhwal, is a shrub, common on the banks of streams in the sub-Himalayan tract from the Jumna to Bhutan, Assam, the Khasia Hills and Burma. *F. Ribes*, Reinwdt.; Fl. Br. Ind. iv. 524; Kurz For. Fl. ii. 458 (*F. polycarpa*, Roxb. Fl. Ind. iii. 556), is an evergreen tree of Tenasserim.

16. F. hispida, Linn. f.; Fl. Br. Ind. v. 522; Bedd. Fl. Sylv. ccxxiv.; Brandis For. Fl. 423; Kurz For. Fl. ii. 460; Gamble Darj. List 75; Talbot Bomb. List 195; Trimen Fl. Ceyl. iv. 195. *F. oppositifolia*, Willd. and *F. dæmonum*, Kön.; Roxb. Fl. Ind. iii. 561, 562. Vern. *Dadúri, degar, rúmbal*, Pb.; *Kagsha, gobla, totmila, kat gularia, konea dumbar*, Hind.; *Kaksa, ghogsha, gobha*, Dehra Dún; *Khagshi*, Garhwal; *Titmoi, jotmida, chinsira*, Kumaon; *Dhedu mera*, Panch Mehals; *Kharwa*, Nep.; *Taksot*, Lepcha; *Dumar, kako-dumar*, Beng.; *Poksha*, Mechi; *Khoskadumar*, Ass.; *Shakab*, Gáro; *Boda-mamadi, bummarri, bumári*, Tel.; *Katumer, bomair*, Gondi; *Koreh*, Kurku; *Maiu-lok*, Magh; *Kotang, sosokera*, Kól; *Kerken*, Khond; *Boda*, Reddi; *Kurubut, dher-umber, kala-umber, kharoti, bokria*, Mar.; *Chona atthi, otta náli*, Tam.; *Eruma nakku*, Mal.; *Kadut*, Burm.; *Kota dimbula*, Cingh.

A moderate-sized tree. *Bark* $\frac{1}{5}$ in. thick, grey, peeling off in irregular flakes, with slight horizontal ribs encircling the tree. *Wood* soft, dirty grey, in regular concentric bands of soft tissue, which alternate with firmer bands of equal width and darker colour. *Pores* scanty, moderate-sized, often oval and subdivided. *Medullary rays* moderately broad and fine, prominent as long narrow bands on a radial section.

Outer Himalaya from the Chenab eastwards, ascending to 3500 ft.; Bengal, Central and South India; Burma and the Andaman Islands; Ceylon.

A very common small tree of quick growth, recognized easily by its having opposite leaves. Kyd's Assam experiments on the wood give W = 25 lbs., P = 360. The

sized and large, often subdivided. *Medullary rays* fine to broad, short, very prominent on a radial section.

Outer Himalaya from the Indus eastward, ascending to 6000 ft.; Khasia Hills, Sylhet, Chittagong and Burma.

A fine species, with large heart-shaped leaves and conspicuous masses of large figs growing on the trunk (see picture in King Ann. Calc. vol. i.). The fruit is eaten and is fairly good. The leaves are used for fodder.

		lbs.
H 606.	Chitul Forest, Kangra (Pengelly)	34
P 149.	Sainj, Simla	34
	Nordlinger's Sections, vol. 3.	

23. **F. pomifera,** Wall.; Fl. Br. Ind. v. 535; Gamble Darj. List 76. *F. regia*, Miq. (in part); Kurz For. Fl. ii. 458. Vern. *Timil, neverra*, Nep.; *Tchongtay*, Lepcha; *Sinthapan*, Burm.

An evergreen tree. *Bark* grey. *Wood* soft, spongy, having narrow bands of soft tissue alternating with broader bands of firm texture. *Pores* scanty, moderate-sized. *Medullary rays* short, moderately broad, very prominent on a radial section.

Eastern Himalaya and Burma at 1–3000 ft., Chittagong.

A species which resembles *F. Roxburghii*, but differs in the fruit. The fruit is edible, one of the best of the edible wild species.

		lbs.
E 689.	Sepoydura Forest, Darjeeling, 5500 ft. (Johnston)	29
	Nordlinger's Sections, vol. 9.	

24. **F. glomerata,** Roxb. Fl. Ind. iii. 558; Fl. Br. Ind. v. 535; Bedd. Fl. Sylv. ccxxiv.; Brandis For. Fl. 422, t. 49; Kurz For. Fl. ii. 458; Gamble Darj. List 76; Talbot Bomb. List 195; Trimen Fl. Ceyl. iv. 96. *F. Chittagonga*, Miq.; Kurz For. Fl. ii. 596. *F. Goolereea*, Roxb. Fl. Ind. iii. 538. Vern. *Kathgúlar, krúambal, rumbal, kakammal, dadhúri*, Pb.; *Gúlar, paroa, lelka*, N.-W. P.; *Khaina*, Garhw.; *Kheunia, umra*, Kumaon; *Khutnia*, Dotiál; *Gúlar*, Oudh.; *Umar, umrai, tue*, C.P.; *Dumri*, Nep.; *Tchongtay*, Lepcha; *Jagya dumar*, Beng.; *Dhimeri*, Uriya; *Láwa*, Melghat; *Thoja*, Gondi; *Alawa*, Kurku; *Lowa*, Sonthal; *Dumer*, Mal Pahari; *Toga*, Khond; *Mori*, Koya; *Budi*, Reddi; *Umbur*, Mar.; *Atti, rumadi, kullakith*, Kan.; *Atti*, Tam.; *Moydi, atti, boddu, paidi, mari, medi*, Tel.; *Attika*, Cingh.; *Thapan, yethapan*, Burm.

A large deciduous tree. *Bark* ½ in. thick, smooth, reddish-brown, with a few large cracks. *Wood* grey or greyish-brown, soft, with broad light-coloured bands of loose tissue alternating with narrower interrupted darker bands of firmer texture. *Pores* large and very large, subdivided. *Medullary rays* moderately broad and fine, bent where they touch the pores.

Salt Range; Outer Himalaya and sub-Himalayan tract from Kashmir eastwards; Assam, Khasia Hills and Bengal; Burma; Central, Western and Southern India; Ceylon.

A very common tree, particularly noticeable from its being deciduous in the middle of the rainy season about August. I have noticed, and Smythies has drawn attention to, this in the Dún; and Graham Anderson mentions it for Mysore. The large fruits appear on the trunk and branches, are produced in profusion, red when ripe and edible, but usually too full of insects. The wood is not durable, but said to last well under water and to be good for well-frames. Cunningham's experiments with bars of Gwalior wood 2′ × 1″ × 1″ gave W = 36 lbs., P = 458. The average weight is about 30 lbs. per cubic foot. If this is the *F. racemosa* of Skinner, No. 71, he gives W = 40 lbs., P = 588. The juice is made into birdlime, and the leaves, bark and fruit are used in native medicine. The leaves are used for cattle and elephant fodder. Graham Anderson says that it is the best tree for shading coffee, and that the wood is used in Mysore for rough purposes, such as outhouse doors and cross-pieces of carts.

The tree is frequently attacked in Mysore, as are also other species like *F. mysoren-*

sis and *F. asperrima*, by a scale insect, *Dactylopius adonidum*, Linn., with which is often associated a black fungoid growth (see Stebbing Inj. Ins. p. 15).

		lbs.
C 1138.	Ahiri Reserve, Central Provinces (R. Thompson)	—
C 839.	Bairagarh Reserve, Berar (Drysdale)	25
C 2796.	Melghát, Berar (Brandis)	—
E 643.	Bamunpokri, Darjeeling Terai (Manson)	25
D 4012.	Cuddapah (Higgens)	34
	Nordlinger's Sections, vol. 8.	

15. ANTIARIS, Leschen.

1. **A. toxicaria**, Lesch.; Fl. Br. Ind. v. 537; Kurz For. Fl. ii. 462; Talbot Bomb. List 196; Trimen Fl. Ceyl. iv. 97. *A. innoxia*, Bl.; Bedd. Fl. Sylv. t. 307; Brandis For. Fl. 427. The Upas tree. Vern. *Alli*, *netavil*, Tam.; *Jazúgri*, *karwat*, *jagúri*, *ajjanpatte*, Kan.; *Jasúnd*, *chandul*, Bombay; *Karwat*, *chandkura*, Mar.; *Aranjili*, *aranthal*, Mal.; *Riti*, Cingh.; *Hmyaseik*, Burm.

A gigantic evergreen tree. *Bark* thick, grey. *Wood* white, soft, even-grained. *Annual rings* faintly marked. *Pores* large and moderate-sized, often subdivided. *Medullary rays* moderately broad, undulating, uniform and equidistant; the distance between two rays generally equal to the transverse diameter of the pores, which are prominent on a vertical section.

Evergreen forests of Burma, the Western Ghâts and Ceylon.

Beddome says it is the largest tree in the forests of the Western Coast, and that it reaches 250 ft. in height, with an enormous girth. Brandis tells me that the tallest tree measured by him in Burma was this species, 250 ft. in height, in the evergreen forests. The inner bark gives a good fibre which makes strong cordage; it is also stripped off whole from a branch or young tree to form sacks which are used to carry rice; a section of the stem being left to serve as a bottom to the sack. Growth fast, 4 to 6 rings per inch of radius.

The celebrated "*upas antiar*" poison is prepared in Java and other islands from the milky juice. Dr. Horsfield says also that when the trunk is extensively wounded, or when the tree is felled, the effluvium of the juice affects the persons exposed to it and causes a kind of cutaneous eruption. Otherwise there is no effect produced by approaching the tree, and to such an extent only are the old fabulous stories of the effects of the Upas tree true. The poison is used to put on arrows to kill game. The history of the extraordinary belief in the deadly power of this tree is discussed in Yule and Burnell's Glossary, Watt's Dictionary, etc.

		lbs.
B 813.	Rangoon Division, Burma (Ribbentrop)	24

16. CUDRANIA, Trécul.

Three species. *C. fruticosa*, Wight; Kurz For. Fl. ii. 434; Fl. Br. Ind. v. 539, is a large climbing shrub of the Khasia Hills, Chittagong and Burma, ascending to 4000 ft. *C. pubescens*, Trécul; Fl. Br. Ind. v. 539; Kurz For. Fl. ii. 435, is an evergreen climbing shrub of Pegu and Martaban, ascending to 3000 ft.

1. **C. javanensis**, Trécul; Fl. Br. Ind. v. 538; Brandis For. Fl. 425; Trimen Fl. Ceyl. iv. 98.; Gamble Darj. List 76. *C. amboinensis*, Kurz For. Fl. ii. 434. *Cudranus Rumphii*, Thw.; Bedd. Fl. Sylv. ccxx. Vern. *Manda*, *mangei*, *kángu*, Hind.

A large straggling spinous shrub. *Bark* smooth, thin, yellowish-brown, with oblong horizontal lenticels, peeling off in thin papery flakes. *Wood* moderately hard, sapwood pale yellow, heartwood orange-yellow. *Annual rings* marked by a belt of large pores, in the rest of the wood *pores* small to large, often subdivided, in roughly concentric patches. *Medullary rays* moderately broad, not numerous, long.

Lower Himalaya and sub-Himalayan tract from the Sutlej eastwards; Khasia Hills, Eastern Bengal and Burma; dry region of Ceylon.

This plant much resembles *Plecospermum spinosum*. The wood is used for fuel, and the ripe fruit is eaten.

		lbs.
O 5006, 5007.	Dehra Dún (Babu U. N. Kanjilal)	47

17. ARTOCARPUS, Linn.

Eight species of indigenous trees, and another cultivated only. *A. calophylla*, Kurz; *A. rigida*, Blume; and *A. Gomeziana*, Wall.; Fl. Br. Ind. v. 541 and 544; Kurz For. Fl. ii. 431 and 433, are scarce trees of Tenasserim and Tavoy. The last-named has been found by Prain in the Coco Islands. *A. incisa*, Linn. f.; Fl. Br. Ind. v. 539; Roxb. Fl. Ind. iii. 527; Bedd. Fl. Sylv. ccxx.; Brandis For. Fl. 426, is the "Bread-fruit" tree of the South Sea Islands, which is cultivated in South India, Burma and Ceylon and bears fruit, but does not stand the cold season in Bengal. It is a fine handsome tree with pinnatifid leaves.

Wood very uniform: heartwood moderately hard to hard, yellow, turning brown on exposure, seasons well, weighs between 30 and 50 lbs., usually containing a white substance. *Pores* moderate-sized to large, often in circular light-coloured rings of softer tissue, prominent on a longitudinal section. *Medullary rays* fine to moderately broad, distinct, not numerous.

1. **A. hirsuta**, Lamk.; Fl. Br. Ind. v. 541; Roxb. Fl. Ind. iii. 521; Bedd. Fl. Sylv. t. 308; Brandis For. Fl. 426; Talbot Bomb. List 196. Vern. *Ayni*, *anjalli*, *aiyanepela*, Tam.; *Aini*, *ansjeni*, Mal.; *Hebalsu*, *heb halasu*, *hebbalsina*, *hesswa*, *hessain*, Kan.; *Hebalsu*, *pat-phanas*, *ran-phanas*, Mar.

A lofty evergreen tree. *Wood* moderately hard: sapwood white; heartwood yellowish-brown, durable, seasons well. *Pores* large, sometimes subdivided, often filled with a white substance. *Medullary rays* fine to moderately broad, wavy, very distinct, but distant, bent where they meet the pores.

Evergreen forests of the Western Gháts, from the Konkan southwards, ascending to 4000 ft.

A fine tree with large ovate leaves, young plants and coppice shoots with deeply pinnatifid very large leaves shaped like large leaves of the English oak. The growth appears to be fast. Skinner, No. 16, gives W = 40 lbs., P = 744; Wallich gives W = 37 lbs., Talbot's experiments of 1885 with pieces 6′ × 2″ × 2″ gave W = 36 lbs., P = 615; Bourdillon gives W = 35 lbs., P = 573. We can take W = 36, P = 644 as an average. The wood does not warp, is not eaten by white ants, and stands contact with water well. The wood is much used on the Western Coast for house and ship building, furniture and other purposes. Foulkes, in "Notes on Timber Trees of S. Kanara," says it is a strong shade-bearer, has a long tap-root, and requires a heavy rainfall and damp climate. He says that the crop of seeds is large, and that they germinate easily, but that, as monkeys are fond of the seeds, they consume much of what is produced. It does not coppice well, but produces abundant root suckers. Seedlings are difficult to transplant.

		lbs.
D 1090.	Madura, Madras (Beddome)	32
W 1219.	North Kanara (Barrett)	31
W 744, 758.	South Kanara (Cherry)	39 and 41

(This last specimen differs by having very short, moderately broad, medullary rays and pores in irregular patches of soft texture; it may possibly be *A. Lakoocha.*)

Nordlinger's Sections, vol. 10 (Tab. XIII. 6).

2. **A. integrifolia**, Linn. f.; Fl. Br. Ind. v. 541; Roxb. Fl. Ind. iii. 522; Bedd. Fl. Sylv. ccxix.; Brandis For. Fl. 425; Kurz For. Fl. ii. 432; Gamble Darj. List 76; Talbot Bomb. List 196; Trimen Fl. Ceyl. iv. 99. The Jack tree. Vern. *Kanthal*,

katol, kathal, Hind.; *Panása*, Uriya; Tel.; *Kanthar*, Sonthal; *Phanas*, Mar.; *Pilla*, Tam.; *Halsu, heb-halsu, halsina*, Kan.; *Porós*, Kól; *Teprong*, Gáro; *Kos*, Cingh.; *Peinnè*, Burm.

A large evergreen tree. *Bark* thick, blackish, deeply cleft when old. *Wood* moderately hard: sapwood pale; heartwood bright yellow, darkening on exposure. *Pores* moderate-sized to large, often oval and subdivided, sometimes filled with a white substance, arranged in irregular patches of soft tissue, which are occasionally elongated concentrically and sometimes confluent, prominent on a vertical section. *Medullary rays* well marked, moderately broad, not numerous.

Indigenous in the forests of the Western Gháts up to 4000 ft.; elsewhere cultivated or run wild, throughout the warmer regions of India, Burma and Ceylon.

I quite share Beddome's belief of the Jack being indigenous in the forests of the Western Gháts, for I have seen it myself in dense forests in wild parts of that country. It is frequently found run wild in forests elsewhere. It is one of the most important of the fruit plants of India, probably, after the mango and plantain, the most important; and good trees are valuable. Graham Anderson mentions two varieties, *Billaru* with poor fruit and *Buckay* with good; as coffee shade he considers the Jack fairly good, though too dense in shade and liable to be troublesome because the fruit is attractive. In young trees the fruit appears on the branches, in older trees on the trunk, and it often reaches a very large size, sometimes 18 in. in length. All inner parts are eaten, the pulp and the seeds, but it has an unpleasant odour which is disliked by Europeans. The wood is used in Burma to dye the yellow clothes worn by the "phoongies," or Buddhist priests. The bark yields a gum; the juice is used as birdlime, and the fruit-juice gives a kind of caoutchouc.

The growth of the tree is fairly fast. The following experiments on the weight and transverse strength of the wood are recorded:—

	Weight in lbs.	P.=
Puckle in 1859 in Mysore (4 experiments), with bars 2′ × 1″ × 1″, found	42	562
Skinner, No. 17, in 1862 in South India . . . . . . ,,	44	788
Adrian Mendis, No. 16, in 1855, in Ceylon, with bars 2′ × 1″ × 1″ ,,	42	712
Wallich . . . . ,,	42	—
,, in 1862 in Travancore . . . . ,,	35	—
Bourdillon, in Travancore . . . . ,,	33	—

And, besides these, we have the Report of Prof. W. C. Unwin, F.R.S. (*Imp. Inst. Journal*, vol. v. p. 124)—

Weight per cubic foot	43 lbs.
Resistance to shearing along the fibres	672 lbs. per square inch.
Crushing stress	3·4 tons per square inch.
Transverse strength	3·053 ,, ,,
Coefficient of elasticity	444·4 ,, ,,

The average weight is probably about 40 lbs. It is very largely used for carpentry, boxes and furniture, and is occasionally exported to Europe for cabinet-work, turning and brush-backs. An analysis of the ashes of 100 lbs. steam-dry wood by Dr. Warth gave 0·70 lb. of ash, of which 0·37 lb. calcium carbonate.

Foulkes, in his "Notes on Timber Trees of S. Kanara," says, the tree requires a deep moist rich soil and heavy rainfall; it has a long tap-root, and is consequently wind-firm; is best reproduced artificially, but the seedlings require care in transplanting; coppices well.

In Calcutta the tree is found to be damaged by the larvæ of the Lymantriid moth, *Perina nuda*, Fabr.

		lbs.
E 598.	Darjeeling Terai (young tree) (Manson)	38
E 2444.	Siliguri, Bengal (Gamble)	41
W 756.	South Kanara (Cherry)	43
B 806.	Tharrawaddy, Burma (Ribbentrop)	30
No. 9, Salem Collection	. . . .	42
No. 16, Ceylon ,,	old; 77, new (Mendis)	44

3. **A. nobilis**, Thw.; Fl. Br. Ind. v. 542; Bedd. Fl. Sylv. t. 309; Trimen Fl. Ceyl. iv. 98. Vern. *Del*, *bedi-del*, Cingh.

A large evergreen tree. *Wood* moderately hard: sapwood greyish-white; heartwood yellow. *Pores* moderate-sized and large, often filled with a white substance, often subdivided, scanty, rather irregularly arranged. *Medullary rays* fine and moderately broad, short, not numerous.

Moist low country of Ceylon, up to 2000 ft.

Beddome calls this a "magnificent tree," and says it grows up to 50 ft. in height and 12 ft. in girth. The leaves are round, large, pinnatifid in young plants and coppice shoots. The wood is used for furniture and other cabinet-work, and the hollowed-out stems are used for fishing-canoes. The seeds are roasted and eaten by Cinghalese. In the *old* Ceylon Collection there were 2 specimens, No. 2 *Aludel* and No. 21 *Del*, both marked *A. pubescens*. I have not now these to refer to, but I have the *new* Collection, in which there are 3 specimens all marked *A. nobilis*. Of these I believe No. 21 *Del* to be right. No. 2 *Aludel* is, I think, *A. Lakoocha*, and No. 109 *Pattadel* is doubtful. The experiments recorded by Adrian Mendis as having been made in 1855 with bars 2′ × 1″ × 1″ gave: No. 2, W = 51 lbs., P = 712; No. 21, W = 40 lbs., P = 528. I am inclined to think No. 21 only was really *A. nobilis*.

The Report of Professor W. C. Unwin, F.R.S. (*Imp. Inst. Journal*, vol. v. p. 124), gave—

Weight	48 lbs. per cubic foot.
Resistance to shearing along the fibres . .	1236 lbs. per square inch.
Crushing stress	2·932 tons per square inch.
Transverse strength	4·155 ,, ,,
Coefficient of elasticity	632·8 ,, ,,

	lbs.
Ceylon Collection, old, No. 21; new, No. 21	40

4. **A. Chaplasha**, Roxb. Fl. Ind. iii. 525; Fl. Br. Ind. v. 543; Brandis For. Fl. 426; Kurz For. Fl. ii. 432; Gamble Darj. List 77. Vern. *Chaplash*, *chaplis*, Beng.; *Lut-ter*, Nep.; *Chram*, Gáro; *Sam*, *sahm*, Ass.; *Cham*, Cachar; *Pani*, *toponi*, Magh; *Taungpeinnè*, Burm.; *Kaita-dá*, And.

A lofty deciduous tree. *Bark* of young trees smooth, light grey with dark blotches; of old trees dark brown, tuberculate, ⅓ in. thick. *Wood* yellow to brown, moderately hard, even-grained, durable, seasons well. *Pores* large, often subdivided, scanty, uniformly distributed, frequently filled with a white substance. *Medullary rays* short, fine and moderately broad.

Lower Himalaya and sub-Himalayan tract from Nepal eastwards, ascending to 5000 ft.; Assam, Eastern Bengal and Chittagong; Burma and the Andaman Islands.

A very handsome tree with a tall straight stem and large broad leaves, which are pinnatifid in young plants and coppice shoots and often 2 ft. in length, resembling in shape a huge leaf of the English oak. It grows to a height of 100 to 120 and even 150 ft., with a clean bole of 60 to 90 ft. and a girth of 10 to 12 ft. A tree has been recorded at Buxa 18 ft. in girth. Peal says "it is a really fine tree having a remarkably good wood for many purposes if not exposed to the weather or put in the ground. Though found scattered all through the mixed plain forests and along the foot of hills in Assam, it is not a gregarious tree, even though the seeds fall and germinate in thousands around its foot. The fruit is greedily eaten by monkeys, and thus transported. The wood would make excellent tea-boxes, but is really too rare and too good to use for such a purpose. It should be seasoned standing by ringing, so as to prevent warping when cut and sawn. It is good for furniture, and when polished often shows a nicely figured grain like coarse satinwood. For planking, battens, girders, joists and wall-plates it is excellent, also for doors and frames. Large dug-out canoes are cut from it" (*Ind. Tea Gazette*). Chevalier Paganini also speaks of it in similar terms, and says he considers it equal to or superior to teak for household furniture. Kurz says the wood is used for canoes and cart-wheels, and I remember its being formerly used for dug-out canoes on the Tista river in Darjeeling

District. The Andaman List (Calcutta Exhibition, 1883–84) says that it "seasons 'quickly, neither cracks nor warps; is proof against dry or wet rot; is not attacked 'by xylophages and rarely by white ants; is used for boat-building, and squares up 'to 60 ft. long, with a siding of 3 ft." Heinig says, however, that it squares to 30 ft., siding 1½ ft.; that it is liable to ring-shakes; and that it is used for door-planking, packing-cases and the inner lining of the hulls of boats.

Growth rather fast, 5 to 6 rings per inch of radius. Weight average about 34 lbs. per cubic foot; Brandis' Burma List of 1862, No. 91 gives 39 lbs.; No. 92 gives 30 lbs. No. 15, Skinner (1862) (*Artocarpus echinatus*, Vern. *Toungpeingnai*), gives Weight = 63 lbs., P = 672, but this seems to be some other species, perhaps *A. rigida*. Bennett (1872) gives Weight = 32 lbs., P = 459 for Andaman wood. The wood seems to get harder and heavier as it gets older; two of our specimens from the Andaman Islands cut in 1866 and stored since then in Calcutta give respectively 46 and 52 lbs. Kurz says it gives a tenacious milky caoutchouc.

		lbs.
E 587.	Khookloong Forest, Darjeeling Terai (young) (Manson) . .	30
E 629.	Eastern Dúars, Assam (Mann)	32
E 2301.	Kámrúp, Assam (Mann)	33
E 2186.	Nowgong " "	35
E 721.	Chittagong (Chester)	33
B 2554.	Burma (Brandis, 1862)	39
B 2693.	Tavoy (Wallich, 1828)	37
B 2683.	" " "	32
B 2204.	Andaman Islands (Colonel Ford, 1866)	52
B 2211.	" " " "	33
B 2289.	" " " "	46
B 512.	" " " "	34
B 2499.	" " (Home, 1874, Nos. 4 and 5) . . .	31, 48

Nordlinger's Sections, vol. 10.

5. A. Lakoocha, Roxb. Fl. Ind. iii. 524; Fl. Br. Ind. v. 543; Bedd. Fl. Sylv. ccxix.; Brandis For. Fl. 426; Kurz For. Fl. ii. 433; Gamble Darj. List 77; Talbot Bomb. List 196; Trimen Fl. Ceyl. iv. 99. Vern. *Tiún, dheu, daheo,* Pb.; *Dahu, dhau, barhat, lakúch,* Hind.; *Dháo, dhanwala,* Kumaon; *Dephúl, dehua,* Beng.; *Dowa, chama, chamba,* Ass.; *Dawa,* Cachar; *Dao,* Sonthal, Kól; *Kamma regu, laku-chamma, nakka-renu,* Tel.; *Wotomba, badhar,* Mar.; *Wonta,* Kan.; *Myauklôk,* Burm.; *Kanagona,* Cingh.

A large deciduous tree. *Bark* ⅓ in. thick, dark grey, rough. *Wood* hard: sapwood large, white, soft, perishable; heartwood yellow, turning dark brown. *Pores* large, enclosed in rings of light-coloured, soft tissue, uniformly distributed, often filled with a white substance. *Medullary rays* fine and moderately broad, distinct, not numerous.

Lower Himalaya and sub-Himalayan tract up to 4000 ft., from Kumaon eastwards, scarce or absent in Sikkim; Assam, Eastern Bengal and Burma; Orissa, Circars and Chota Nagpore (scarce); forests of the Western Gháts from the Konkan southwards, up to 3000 ft.; moist region of Ceylon; Andaman Islands: often cultivated.

A fine tree, though not so remarkable as *A. Chaplasha*. It is more common in cultivation than in the forests, and is more important as a fruit tree than as a timber tree, for the fruit is a favourite one, and may be seen on sale in bazaars even so far north as Saharanpur and Dehra Dún. To European notions it is somewhat insipid. The male flower-heads are also eaten, raw or pickled. Foulkes, in his "Notes on Timber Trees of S. Kanara," says the tree grows best on laterite, requires a moist climate and reproduces well if the seeds are not destroyed by pigs and porcupines.

The growth is fast, 3 to 4 rings per inch of radius. The average weight of the wood is 40 lbs. per cubic foot, as given by Brandis in his Burma List of 1862, No. 92. Bourdillon gives W = 43, P = 477. In the Andamans List, Calcutta Exhibition, 1883–84, the wood is said to be difficult to saw on account of a resinous substance, but it is easy to plane. It is highly prized at Port Blair. Heinig says that it squares up to 45 ft. in length with 18 in. in siding, and is used for house-posts, beams and canoes. It is also used for furniture, and resists white ants and teredo. Foulkes says that in

S. Kanara it is used for posts, rafters, piles in water and sugar-mills, and that it resists white ants.

			lbs.
E 2445.	Siliguri, Bengal (Gamble)	. . . .	48
E 794.	Kámrúp, Assam (G. Mann)	. . . .	36
E 1402.	Chittagong (Chester)	. . . .	43
W 740.	South Kanara (Cherry)	. . . .	47
B 810.	Rangoon Division, Burma (Ribbentrop)	. . . . .	30
B 2553.	Burma (Brandis, 1862)	. . . .	39
No. 67, Ceylon Collection, old (marked *Artocarpus* sp., Vern. *Patta-del*)			34
No. 2, Ceylon Collection, new, Vern. *Aludel.*			
Nordlinger's Sections, vol. 10 (*A. mollis*).			

18. BALANOSTREBLUS, Kurz. *B. ilicifolia*, Kurz For. Fl. ii. 465; Fl. Br. Ind. v. 544, is an evergreen small tree of the forests of Chittagong and Upper Burma.

TRIBE V. CONOCEPHALEÆ.

19. CONOCEPHALUS, Blume. *C. suaveolens*, Blume; Fl. Br. Ind. v. 546; Kurz For. Fl. ii. 430; Gamble Darj. List 77 (*Urtica naucleiflora*, Roxb. Fl. Ind. iii. 657); Vern. *Gulsuné*, Nep., is a large climber of the lower hills and sub-Himalayan tract of Sikkim and eastwards to Assam, the Khasia Hills and Burma, especially along streams. Kurz says it has a brownish porous light wood.

20. HULLETTIA, King. *H. Griffithiana*, King; Fl. Br. Ind. v. 547 (*Dorstenia Griffithiana*, Kurz For. Fl. ii. 462), is an evergreen shrub of Tenasserim.

TRIBE VI. URTICEÆ.

Girardinia heterophylla, Dcne.; Fl. Br. Ind. v. 550; Brandis For. Fl. 404; Gamble Darj. List 77 (*Urtica heterophylla*, Roxb. Fl. Ind. iii. 586); Vern. *Keri, kingi, ein, sanbli, an, ján, kal, kárla, bhabar*, Pb.; *Awa, alla, chichru, bichua, kushki*, Hind.; *Ullo*, Nep.; *Kazu*, Lepcha; *Horu surat*, Ass.; *Serpa, herpa*, Bhutia, is an extremely common, large, annual forest weed with long stinging bristles. It affords a fine silky fibre, which is used in Sikkim for ropes, twine, and coarse cloth like gunny. It is common throughout most of the hilly districts of India and Burma, but especially in the Himalaya.

21. LAPORTEA, Gaud.

1. **L. crenulata**, Gaud.; Fl. Br. Ind. v. 550; Bedd. Fl. Sylv. t. 306; Brandis For. Fl. 404; Kurz For. Fl. ii. 421; Gamble Darj. List 77; Talbot Bomb. List 197; Hook. Fl. Ceyl. iv. 105. *Urtica crenulata*, Roxb. Fl. Ind. iii. 591. The Fever Nettle or Devil Nettle. Vern. *Chorpatta, surat*, Beng.; *Moringi*, Nep.; *Mealum-ma, sun-krong*, Lepcha; *Sirnat*, Ass.; *Petyagyi*, Burm.; *Otta plavu*, Tam.; *Ana choriya*, Mal.; *Maússa*, Cingh.

A large evergreen shrub or small tree. *Wood* very soft, separating when dry into concentric fibrous layers. *Pores* large. *Medullary rays* indistinct.

Lower Himalaya and sub-Himalayan tract from Nepal eastwards, up to 4000 ft.; Assam, Khasia Hills, Chittagong and Burma; Konkan (Stocks); Hills of Rumpa in N. Circars; Western Coast in Malabar and Travancore; damp forests of Ceylon up to 5000 ft.

This is the worst of the stinging nettles of India, the very minute stinging hairs giving out a poison whose effects are severe and lasting, and are especially noticeable after the application of water. I have myself experienced it, and for some long time after being stung, felt an acute pain every time I washed my hand where the nettle had touched me (see also "Ind. Forester," xviii. 148). In his "Himalayan Journal," Sir Joseph Hooker says, "The great shrubby nettle is held in so great dread that I 'had difficulty in getting help to cut it down. I gathered many specimens without 'allowing any part to touch my skin; still, the scentless effluvium was so powerful 'that mucous matter poured from my eyes and nose all the afternoon in such abundance 'that I had to hold my head over a basin for an hour." Leschenault de la Tour, quoted

by Lindley ("Veg. Kingdom," p. 261) and by Beddome, describes the symptoms very similarly, and says that it took nine days to get rid of the effects of a very slight touch on three fingers of his hand. Beddome, however, says that his experience, often obtained, does not quite agree with Leschenault's, but there may be degrees of intensity corresponding to differences of season, climate, etc. Indeed, Sir Joseph Hooker records it as a fact that the sting is only bad in autumn. Mr. J. A. Gammie once told me that he had suffered severely in preparing for Government a sample of the fibre; and certain forest officers have described to me the effect of stings upon them, which if not quite so bad as those experienced by Hooker and Leschenault, were very serious, and corresponded to my own personal experience already referred to. Hooker remarks that though Endlicher had attributed the causticity of the nettle-juice to bicarbonate of ammonia, neither he nor Dr. Thomson had found that substance in *L. crenulata*. There are species in Java, Australia and elsewhere, whose effects are similar if not worse. The plant gives a fibre, but it is difficult to prepare and not so good as that given by other and commoner *Urticeæ*.

W 4716. Travancore (Bourdillon).

22. BOEHMERIA, Jacq.

Ten species, shrubs or small trees, mostly giving fibres of use for cordage, weaving, etc. Four of them are small or scarce, and of no importance; four of the rest are common shrubs of the forest undergrowth, and the other two small trees, one rather important, in the Outer Himalaya. *B. malabarica*, Wedd.; Fl. Br. Ind. v. 575; Kurz For. Fl. ii. 422; Gamble Darj. List 77; Talbot Bomb. List 197; Trimen Fl. Ceyl. iv. 113 (*B. travancorica*, Bedd. Fl. Sylv. ccxxv.); Vern. *Takbret*, Lepcha; *Maha-diya-dal*, Cingh., is a large shrub of the Sikkim Himalaya ascending to 5000 ft., Assam, the Khasia Hills, Chittagong, Burma, the Western Ghâts and Ceylon, whose inner bark gives an excellent fibre. *B. Hamiltoniana*, Wedd.; Fl. Br. Ind. v. 579; Kurz For. Fl. ii. 424; Gamble Darj. List 77; Vern. *Taksur*, Lepcha; *Kanait seik*, Magh; *Satsha*, Burm. and *B. polystachya*, Wedd.; Fl. Br. Ind. v. 579; Gamble Darj. List 78; Vern. *Phusre kamli*, Nep.; *Taksur*, Lepcha, are shrubs of the Central and Eastern Himalaya, the Khasia Hills and the hill ranges down to Burma, the former in the lower hills, the latter ascending to 7000 ft. and found westwards as far as Kumaon.

B. nivea, Hook. and Arn. is the well-known and important fibre-plant which has been very much under discussion of late years. It is found in two very distinct varieties, or perhaps species, *B. nivea*, the "China grass," distinguished by the white under-surface of the leaves, and *B. tenacissima*, Gaud., the "*Ramie*," distinguished by the leaves being green on both surfaces. The China grass is a plant of temperate climates, and can be grown in the open air in Europe, while the Ramie is a tropical plant which cannot be so grown. The fibre of both species is of similar quality and is excellent; but there are difficulties connected both with the regular and cheap growth of the plant in quantity and with the extraction of the fibre, which have still to be got over before it can take its place in the market and compete with silk, flax, jute and cotton (see Kew Bulletin, Addl. Series, ii., 1898, and many other publications). It might be a useful plant to grow as a nurse in Teak and other forest plantations in a suitable soil and in a locality whence carriage to the port of shipment is cheap; but it would have to be grown in large quantity, cut and supplied regularly, and treated in a suitable machine whenever such a one is available. It must, however, be remembered that it requires a rich soil, and that the idea that it could be grown profitably as a reclaimer of poor waste lands must be completely abandoned. A full account of the Rhea and its substitutes is given by Dr. G. Watt in "Agricultural Ledger," 1898, No. 15.

1. **B. rugulosa**, Wedd.; Fl. Br. Ind. v. 577; Brandis For. Fl. 403; Gamble Darj. List 77. Vern. *Geti*, *gainti*, *genthi*, Garhwal, Kumaon; *Dar*, Nep.; *Sedeng*, Lepcha.

A small or medium-sized evergreen tree. *Bark* dark brown, rough, deeply fissured into more or less rectangular scales. *Wood* red, moderately hard; very smooth, even-grained, seasons well and cuts cleanly. *Pores* moderate-sized to large, often subdivided, scanty.

Medullary rays fine to broad, not numerous, the distance between them usually greater than the diameter of the pores, giving a good silver-grain on a radial section.

Himalaya, on dry slopes in the lower hills up to 3000 ft. from the Sutlej eastwards to Bhutan, very common about the Jumna, in Garhwal, Kumaon and Darjeeling; hills of Upper Burma.

A useful tree with a remarkable wood, which is in great use for making bowls, cups, plates and all kinds of domestic utensils, especially those destined to hold milk, butter, ghi and curds. It is also made into small boxes, spoons and various other articles, for which its character of being easily cut and carved without splitting or warping well adapts it. It is a tree which should be encouraged and protected on the dry slopes which it affects, not only as being valuable in covering the ground and binding it, but as being in demand for village purposes, for which pieces of good size and quality are requisite. It should therefore be specially provided for in Working Plans. The growth is fast, 2 to 5 rings per inch of radius, and the wood weighs on an average 41 lbs. per cubic foot.

			lbs.
O	324.	Garhwal (1868)	35
O	3000.	„ (1874)	44
E	600.	Khookloong Forest, Darjeeling Terai (Manson) . . .	—
E	2443.	Mangwa, Tista Valley, Darjeeling, 3000 ft. (Gamble) . .	39

Nordlinger's Sections, vol. 9 (*Urtica rugulosa*).

2. B. macrophylla, Don; Fl. Br. Ind. v. 577; Brandis For. Fl. 403; Kurz For. Fl. ii. 424; Gamble Darj. List 77. Vern. *Bara siáru*, Dehra Dún; *Saochála, golka*, Kumaon; *Kamli*, Nep.; *Pao*, Lepcha.

A large shrub. *Bark* greyish-brown, rough, with small lenticels. *Wood* light reddish-brown, moderately hard. *Pores* small to moderate-sized, scanty. *Medullary rays* moderately broad, rather distant.

River-beds in the sub-Himalayan tract from the Jumna eastwards; Khasia Hills and hills of Upper Burma up to 4000 ft.

A pretty shrub with long narrow leaves and very long drooping flower-spikes. It gives a good fibre, used for ropes and fishing-lines.

O 5089. Nagsidh, Dehra Dún (Babu U. N. Kanjilal).

3. B. platyphylla, Don; Fl. Br. Ind. v. 578; Brandis For. Fl. 403; Gamble Darj. List 77; Talbot Bomb. List 197; Trimen Fl. Ceyl. iv. 114. Vern. *Bimol, siár, khaksha*, Garhwal; *Gargela*, Kumaon; *Kamli*, Nep.; *Dangnosooketek*, Lepcha; *Satsha*, Burm.

A large shrub. *Bark* thin, greyish-brown, longitudinally striated. *Wood* reddish-brown, moderately hard, with occasional concentric bands of lighter and darker colour. *Pores* moderate-sized, scanty. *Medullary rays* moderately broad, rather distant.

Outer Himalaya, ascending to 7500 ft.; Assam, Khasia Hills and Burma; Behar, Chota Nagpore, C.P., Orissa and Circars; throughout the hill country of Western and Southern India; moist region of Ceylon up to 6000 ft.

A very common shrub of forest undergrowth, especially in ravines, and very variable. It is said to give a useful fibre, but it is not much used, and the plant is not cultivated for the purpose.

E 3317. Darjeeling, 6500 ft. (Gamble).

23. POUZOLZIA, Gaud.

Many species, mostly herbaceous, one only reaching any size.

1. P. viminea, Wedd.; Fl. Br. Ind. v. 581; Brandis For. Fl. 405; Kurz For. Fl. ii. 425; Gamble Darj. List 78. Vern. *Chota kúail, chipali*, Nep.; *Kyingbi*, Lepcha.

A shrub or small tree. *Bark* thin, grey. *Wood* light reddish-brown, hard, apt to warp. *Pores* small and moderate-sized, often

subdivided, uniformly distributed. *Medullary rays* moderately broad, numerous, uniform and equidistant.

Himalaya, from the Sutlej eastwards to Sikkim; Assam, Eastern Bengal, and Chittagong; ascending to 5000 ft.

Chiefly found in patches of abandoned cultivation, where it grows into a small tree. Its growth is quick. The leaves are eaten by Lepchas. The bark is used to make ropes.

		lbs.
E 2447.	Latpanchor, Darjeeling, 4500 ft. (Gamble)	37

24. SARCOCHLAMYS, Gaud. *S. pulcherrima*, Gaud.; Fl. Br. Ind. v. 588; Brandis For. Fl. 405; Kurz For. Fl. ii. 426 (*Urtica pulcherrima*, Roxb. Fl. Ind. iii. 588); Vern. *Satsha*, Burm., is a large handsome evergreen shrub or small tree with tubercled stems and trinerved leaves, common in Assam, the Khasia Hills, Eastern Bengal and Burma, especially in deserted cultivation patches and along streams. Kurz says that the *wood* is of a pale reddish-brown colour, rather light and soft, and of a fine silvery fibre; and that the *bark* gives a good fibre for cordage.

25. VILLEBRUNEA, Gaud.

1. **V. integrifolia**, Gaud.; Fl. Br. Ind. v. 589; Gamble Darj. List 78; Talbot Bomb. List 197; Trimen Fl. Ceyl. iv. 118. *Oreocnide sylvatica*, Bedd. Fl. Sylv. ccxxv.; Kurz For. Fl. ii. 427. *Urtica acuminata*, Roxb. Fl. Ind. iii. 592. Vern. *Lipic, lipia*, Nep.; *Kaphitki*, Lepcha; *Ban kotkora*, Ass.; *Ritza, jutta*, Naga; *Lookoy*, Singpho.

A small tree. *Bark* brown, thin. *Wood* white, soft. *Pores* moderate-sized to large, scanty. *Medullary rays* moderately broad to broad, not numerous; silver-grain well marked.

Eastern Himalaya up to 4000 ft.; Assam, Khasia Hills and Chittagong; Burma; Western Ghâts and Ceylon, chiefly in deserted cultivation patches.

A quick-growing shrub giving a useful fibre of a brown colour, called "*ban riha.*" It is used in the Darjeeling Hills to make ropes, nets and coarse cloth. It has been tried in cultivation in the Nilgiris, but I have failed to find with what result. Watt (*Agric. Ledger*, 1898, No. 15, p. 108) has a high opinion of the plant as a fibre-yielder, and seems to think that as a bye-crop it is more likely to pay in Assam than Rhea. It seems to me that the objection to it, as to most forest fibres of the kind, is that (i.) it requires the best soil to do well, and (ii.) it must be produced very cheaply—that is, at any rate, where freight will not be prohibitive. These conditions are not easy to find together.

Khasia Hills—Kew Museum (J. D. Hooker).

1. **V. frutescens**, Blume; Fl. Br. Ind. v. 590; Brandis For. Fl. 406; Gamble Darj. List 78. *Urtica frutescens*, Roxb. Fl. Ind. iii. 589. Vern. *Gar tashiára, poidhaula, kagshi*, Kumaon; *Kirma*, Nep.; *Takbret*, Lepcha.

A shrub. *Bark* rough, dark grey. *Wood* brown, moderately hard. *Pores* small. *Medullary rays* fine and broad, equidistant, the distance between the rays equal to the transverse diameter of the pores.

Himalaya, from Simla eastwards to Sikkim, Bhutan and Assam, ascending to 5000 ft.; Khasia Hills; Nilgiri Hills in S. India.

The fibre is used for ropes.

H 3130. Simla, 5000 ft. (Gamble).

26. DEBREGEASIA, Gaud.

Five species. *D. dentata*, Hook. f.; Fl. Br. Ind. v. 591, is a shrub of Chittagong. *D. ceylanica*, Hook. f.; Fl. Br. Ind. v. 592; Trimen Fl. Ceyl. iv. 119, is a small tree of the low country of Ceylon with orbicular leaves, snow-white beneath and resembling those of *D. Wallichiana*.

Wood soft, useless, light brown. *Pores* small or moderate-sized, scanty. *Medullary rays* moderately broad.

1. **D. velutina,** Gaud.; Fl. Br. Ind. v. 590; Gamble Darj. List 78; Talbot Bomb. List 198. *D. longifolia,* Wedd.; Brandis For. Fl. 405. *Morocarpus longifolius,* Bl.; Bedd. Fl. Sylv. ccxxvi.; Kurz For. Fl. ii. 428. Vern. *Sansáru, siáru,* Dehra Dún; *Tashiári,* Nep.; *Kamhyem,* Lepcha; *Kapsi, kurgul,* Kan.; *Putchaw,* Burm.

A small tree. *Bark* thin, greyish-brown, rough. *Wood* reddish-brown, hard. *Pores* moderate-sized, scanty; annual rings marked by a line of closer pores. *Medullary rays* moderately broad, uniform, the distance between them equal to, or greater than, the transverse diameter of the pores.

Central and Eastern Himalaya from Kumaon to Sikkim up to 7000 ft.; Khasia Hills; South India; Burma; Ceylon. Common on old cultivated lands.

Growth fast, 4 rings per inch of radius. The fibre of the bark is occasionally used for ropes and to make fishing-nets.

		lbs.
E 3328.	Darjeeling, 6500 ft. (Gamble)	34

2. **D. hypoleuca,** Wedd.; Fl. Br. Ind. v. 591. *D. bicolor,* Wedd.; Brandis For. Fl. 405. *Urtica bicolor,* Roxb. Fl. Ind. iii. 589. Vern. *Kharwala, shakai,* Afg.; *Chainchar, chainjli, amrer, sandári,* Jhelum; *Sansáru, súss,* Chenab; *Siaru, talsiari,* Ravi; *Pincho, prin,* Sutlej; *Tashiári,* Kumaon; *Siár, sinar,* Jaunsar; *Sansáru, siáru,* Dehra Dún.

A large shrub. *Bark* thin, grey. *Wood* soft, grey. *Pores* small and moderate-sized, scanty, uniformly distributed. *Medullary rays* moderately broad, uniform and equidistant.

Salt Range; West Himalaya, ascending to 5000 ft., chiefly along watercourses.

Growth fast, 3 to 4 rings per inch of radius. The fibre is made into twine and ropes. The fruit is eaten.

		lbs.
H 88.	Bhajji, Simla, 4000 ft.	27

3. **D. Wallichiana,** Wedd.; Fl. Br. Ind. v. 591; Gamble Darj. List 78. *Morocarpus Wallichianus,* Miq.; Kurz For. Fl. ii. 428. Vern. *Púrúni,* Nep.; *Senén,* Lepcha.

A small tree, erect or epiphytic. *Bark* brown, fibrous, peeling off in small vertical papery flakes. *Annual rings* distinctly marked by a white line. *Pores* large, scanty. *Medullary rays* fine to moderately broad, often bent where they touch the pores.

Eastern Himalaya up to 7000 ft.; Khasia Hills and down to the upper forests of the Pegu Yoma.

Growth moderate, 5 rings per inch of radius. A very pretty plant with round leaves of the purest white beneath. The fibre is sometimes used for cordage.

E 3329. Darjeeling, 6000 ft. (Gamble).

27. MAOUTIA, Wedd. *M. Puya,* Wedd.; Fl. Br. Ind. v. 592; Brandis For. Fl. 406; Kurz For. Fl. ii. 429; Gamble Darj. List 78; Vern. *Pói, púa,* Hind.; *Dhaul kagshi, chawna,* Dún; *Puya,* Nep.; *Kyinki,* Lepcha; *Yenki,* Limbu; *Satsha,* Burm., is a shrub with leaves very white beneath, found in the Lower Himalaya and sub-Himalayan tract from the Jumna eastwards, the Khasia Hills and Burma, up to 4000 ft., chiefly in ravines and on old cultivated lands. The fibre is good and strong and used to make fishing-nets, net bags, twine and cloth. Various experiments have been made with it to ascertain its possible value as a marketable product, but so far it has not been found worth cultivation. It is nowhere sufficiently common in the forests to be worth collecting. See, also, Watt in "Agric. Ledger," 1898, No. 15, p. 120, with fig.

ORDER CI. PLATANEÆ.

1. PLATANUS, Linn.

This, the only genus of the Order, contains about 5 species, all but one American. *P. occidentalis*, Linn. is the common Plane, Sycamore or Buttonwood of North America, said by Hough to be the largest though not the tallest deciduous tree of the American forests, reaching 120 ft. in height and 44 ft. in girth, and affecting river-banks, where it is conspicuous on account of its very white upper branches. The tree cultivated in Europe as *P. occidentalis* is *P. orientalis*, Linn., var. *acerifolia*, Ait. (Hook. f. in Fl. Br. Ind. v. 594).

1. **P. orientalis**, Linn.; Fl. Br. Ind. v. 594; Brandis For. Fl. 434. The Plane tree. *Platane*, Fr. Vern. *Chinár*, Pers., Afgh.; *Búin, búna, boin*, Kashmir.

A large deciduous tree. *Bark* ⅙ in. thick, smooth, light or dark grey, peeling off in large thin scales. *Wood* white, hard, with a faint tinge of yellow or red. *Annual rings* marked by a band of firm texture with few pores on the outer edge of each ring. *Pores* small, very numerous, uniform, and uniformly distributed except in the outer band of the autumn wood. *Medullary rays* broad, equidistant, showing on a radial section as a glossy, irregular, shining silver-grain; between the broad rays are occasional short fine ones. On a tangential section the grain appears in the form of short lenticular plates.

Cultivated in Baluchistan, Afghanistan, and the West Himalaya as far as the Sutlej, ascending to 8300 ft. in Ladak. Indigenous in Greece, Macedonia, Armenia and Northern Persia.

The Plane is a very handsome tree, and is planted for ornament in Kashmir and neighbouring regions, also in Afghanistan and in the hills of the Kuram, and it has been considerably planted in Baluchistan since Quetta became a British province. Aitchison says that it sometimes reproduces itself naturally, and though originally planted in a valley is capable of working uphill (*Journ. Linn. Soc.*, xviii. 94). Brandis mentions the large grove called the Nasim Bagh, on the banks of the Kashmir lake, planted by Akbar the Great soon after he had conquered Kashmir in 1588. In 1838, Vigne found their average girth to be 13 ft. This gives a growth of about 10 rings per inch of radius. Mathieu mentions a tree in the grounds of the Forest School at Nancy in France, which had 12·3 ft. girth at 130 years, which is equivalent to about 5½ rings. No. H 922 shows 6 rings. The growth may therefore be said to be fairly fast. The largest girth noted by Dr. Stewart was 28 ft.

The wood resembles that of the beech, differing in having the broad medullary rays more numerous and regular, and the annual rings not wavy. Its weight is given by Mathieu at 41 to 49 lbs. per cubic foot; but the lower figure is probably the best average for Indian wood. The experiments made at Kandahar in 1879 by Capt. Call, R.E. ("Ind. Forester," v. 478), with bars 1′ × 1″ × 1″ gave W = 38·8 lbs., P = 587. "The wood is not valued in Kashmir except to make boxes, trays, pen-cases and 'similar articles, which are lacquered and painted. In Afghanistan, where timber is 'scarce, it is said to be used for gun-carriages" (Brandis). Mathieu says that it is equal to beech as a firewood, with the quick growth of the poplar, and that, though not found wild in the forests, it is worth cultivation. But it requires a light and moist soil, and does best on the banks of streams. It can be easily propagated by layers, and Nicholson recommends this as the best plan, though it can be grown well from seed. The seed is very small, contained in round balls which require to be broken, and it suffices to press the seeds lightly into the ground without covering them with earth. The var. *acerifolia* is the tree sometimes called the "London Plane." It is conspicuous in the parks and squares of London, and is remarkable for its capability of resisting the effects of smoke and fog.

	lbs.
H 922. Hazara (Baden-Powell)	41

Nordlinger's Sections, vol. 8 (*P. acerifolia*) (Tab. XV. 3).

Plate No. 13 of Hough's "American Woods" represents *P. occidentalis*, L. The wood structure is much the same in all sections as that of *P. orientalis*, but it shows a conspicuously red heartwood. Hough gives W = 35·4; percentage of ash 0·46.

ORDER CII. JUGLANDACEÆ.

Two Indian genera, Juglans and Engelhardtia.

The "Hickory" trees of America are species of *Carya*, the chief species being *C. alba*, Nutt., the "Shell bark," giving a timber of value chiefly in carriage-building and for tools and implements.

Wood moderately hard, greyish-pink or brown, with fine concentric lines. *Pores* scanty, moderate-sized or large, usually subdivided. *Medullary rays* variable, fine.

1. JUGLANS, Linn.

The "Black Walnut" tree of America is *J. nigra*, Linn. *J. cinerea*, Linn., is the "Butternut."

1. J. regia, Linn.; Fl. Br. Ind. v. 595; Roxb. Fl. Ind. iii. 631; Brandis For. Fl. 497; Kurz For. Fl. ii. 490; Gamble Darj. List 78. The Walnut. *Noyer*, Fr.; *Wallnuss*, Germ.; *Noce*, Ital.; *Nogal*, Span. Vern. *Charmaghz*, Pers.; *Ughz*, *waghz*, Afg.; *Akhor*, *khor*, *krot*, *dún*, Kashmir; *Kabotang*, *thanka*, Pb.; *Starga*, Ladak; *Ká*, *khol*, Kunawar; *Akhor*, *okhár*, Jaunsar; *Akhor*, *kharot*, Kumaon; *Akhrot*, Hind.; *Kabshing*, Byans; *Akrút*, Beng.; *Kól*, Lepcha; *Tagashing*, Bhutia.

A large deciduous tree. *Bark* grey, characteristically marked by deep vertical parallel fissures, ½ in. to 2 in. thick. *Wood* moderately hard, even-grained: sapwood broad, greyish-white; heartwood greyish-brown with darker streaks, often beautifully mottled. *Annual rings* marked by a sharp line without pores. *Pores* moderate-sized, not numerous, sometimes oval and subdivided, often in oblique lines, somewhat more numerous and larger in the spring wood, conspicuous on a longitudinal section. *Medullary rays* very fine to fine, and even moderately broad, variable in arrangement, silver-grain inconspicuous. Numerous regular, very fine, wavy, concentric bars joining the medullary rays.

Forests of the Himalaya, extending west to Afghanistan and Baluchistan and east to Bhutan at 3–10,000 ft.; Hills of Upper Burma; cultivated extensively in the Himalaya, also in the Khasia Hills, occasionally too, perhaps, in gardens in other hill ranges. It extends through Persia to Armenia, and is commonly cultivated in Europe.

The Walnut grows to a very fine tall tree in suitable localities in the Himalayan forests. Brandis says that it reaches in the Western Himalaya, 80 to 100 ft. in height, and 10 to 15 and even 20 ft. in girth; and adds that exceptional trees have been measured which reached 28 ft. Kanjilal mentions trees running up to 120 ft. in height. Aitchison says that in Shalizan the Walnut groves are very fine, trees reaching 12 and even 17 ft. in girth. In the Sikkim Himalaya it attains 80 to 100 ft. in height, with 30 to 40 ft. to the first branch, and a girth of 10 to 12 ft. Cultivated trees, however, are usually short and thick in bole with a low spreading crown. In the Western Himalaya it prefers ravines and valleys with a northern aspect at about 5000 ft.; in the Eastern Himalaya it goes somewhat lower and does not rise so high. Manson says it likes best a southern or western aspect. Its natural reproduction is not very good, probably because of the many enemies who are attracted by its edible nuts—monkeys, squirrels, parrots, hornbills, nutcrackers, etc. It is easily grown artificially, and at suitable elevations and in suitable localities thrives well and grows quickly. Considering that walnut wood has proved, after many experiments, to be the only really suitable wood for gunstocks, and that the European supplies are becoming exhausted, it is distinctly a matter for serious consideration whether it should not be largely cultivated in the Indian mountains, for although the tree is widely spread, it is quite sporadic, and the available natural-grown material is not great. It might be grown as a standard in coppice forests, but the localities would require very careful attention.

As already stated, the chief use of the wood is for gunstocks, but it is also a valuable

furniture wood, perhaps the most valuable of the Himalayan furniture woods both in the East and the West, as it works well, does not warp or split, and looks handsome. In the Darjeeling Hills it was formerly more abundant and was extensively employed in building, some houses and notably the inspection house of the Cinchona Department at Rangbi having nearly all their woodwork made of it. In Kashmir it is used for lacquer ware, and throughout Kashmir and the Punjab it is used for carvings, beautiful specimens of which were exhibited in the great Central Trophy at the Paris International Exhibition of 1900. A certain amount of the wood is always exported from the hills and kept for sale in forest depôts. The growth is fairly fast, experiments having shown a growth of 15 rings per inch of radius, as an average for the West Himalaya; 6 rings for the Sikkim Himalaya and 3¼ rings for planted trees in the latter. The average weight of the wood is about 44 lbs. per cubic foot.

Walnut "burrs" are very valuable, and large exports of them have been made at times from Kashmir chiefly to France.

The bark is used as a dye and in medicine; and is exported to the plains for cleaning the teeth (Brandis). The twigs and leaves are used for fodder. It is commonly cultivated for its fruit throughout the Himalaya; the wild tree has a thick shell and small kernel, and is rarely eaten; the cultivated trees are of numerous kinds, one of the best being the thin-shelled or *Kaghazi* variety. A clear, good description of oil is made from the fruit, and the rind is used for tanning and dyeing.

			lbs.
H	3163.	Dungagalli, Hazara, 7000 ft. (Wild)	—
H	7.	Theog, Simla, 5000 ft.	—
H	9.	Matiyana, Simla, 7000 ft.	38
H	29.	" " "	43
H	15.	Jubal, 4000 ft.	33
H	35.	Madhan, 6000 ft.	41
H	780.	Chamba, 4000 ft. (Pengelly)	46
H	125.	Ralla, Kulu, 6000 ft. (Col. Stenhouse)	42
H	428.	Durani block, Deoban, Jaunsar, 6000 ft. (Bagshawe)	43
E	357.	Tukdah Forest, Darjeeling, 5000 ft. (Johnston)	28
E	2440.	Darjeeling, 6000 ft. (Gamble)	37
E	2441.	Rangirúm Forest, Darjeeling, 5000 ft. (Gamble)	33
E	3587, 3632.	Darjeeling, 7000 ft. (planted)	—
		Nordlinger's Sections, vol. 1.	

2. ENGELHARDTIA, Lesch.

Three species. *E. acerifolia*, Blume; Fl. Br. Ind. v. 596, is a tree of the Sikkim Himalaya, the Khasia Hills and Chittagong, rising to 5000 ft.

Wood pinkish-grey with very fine interrupted, wavy belts in concentric arrangement. *Pores* moderately large to large, scanty, usually subdivided. *Medullary rays* fine, numerous.

1. **E. spicata**, Bl.; Fl. Br. Ind. v. 595; Brandis For. Fl. 500; Kurz For. Fl. ii. 491; Gamble Darj. List 79. *E. Roxburghiana*, Lindl.; Brandis For. Fl. 500. *Juglans pterococca*, Roxb. Fl. Ind. iii. 631 (in part). Vern. *Silapoma*, Hind.; *Mowa, mahua*, Nep.; *Savyak*, Lepcha; *Bolas*, Beng.; *Rumgach*, Ass.; *Bor-patta-jam*, Cachar; *Dinglaba*, Khasia; *Vakru*, Gáro; *Taungtamasôk*, Burm.

A large deciduous tree. *Bark* grey, moderately smooth. *Wood* reddish-grey, moderately hard, with numerous exceedingly fine, wavy, interrupted, concentric, dark lines of loose tissue. *Pores* moderate-sized and large, scanty, usually subdivided, often in somewhat oblique lines, prominent on vertical sections. *Medullary rays* very fine to fine, irregularly spaced, bent where they meet the pores, causing a distinct satiny silver-grain on a radial section.

Outer Himalaya and Sub-Himalayan tract from Nepal eastwards, rising to 6000 ft.; Assam, Khasia Hills, Eastern Bengal and Chittagong; hills throughout Burma, and the Shan States.

A handsome and conspicuous tree which may reach 100 ft. in height and a girth of

8 to 12 ft. In some localities it is almost gregarious and forms a kind of coppice growth, as at Nagri in the Darjeeling Hills. Natural reproduction is excellent wherever the seedlings can get sufficient light and be protected from cattle.

The wood is useful; it is employed for tea-boxes and for building purposes, and in the Khasia Hills spoons are made of it. It can be used for carving, and I believe that it was of this wood that the handsome carved oriel window and water-conduit exhibited at the Paris International Exhibition of 1900 by Major Armstrong of the Residency at Katmandu were made. Wallich gives W = 40 lbs., but the average of the specimens enumerated is only 33 lbs. per cubic foot. Kurz says the bark can be used for tanning.

		lbs.
E 653.	Bamunpokri, Darjeeling Terai (Manson)	30
E 687.	Sepoydura Forest, Darjeeling, 5000 ft. (Manson)	33
E 2442.	Chuttockpur Forest, Darjeeling, 6000 ft. (Gamble)	36

Nordlinger's Sections, vol. 9 (Tab. XV. 4).

2. **E. Colebrookiana**, Lindl.; Fl. Br. Ind. v. 596; Brandis For. Fl. 499. *E. villosa*, Kurz For. Fl. ii. 491. Vern. *Timar rúkh*, Pb.; *Mowa, mauwa*, Jaunsar; *Gadhmowa*, Garhwal; *Gobar mowa, bhati mowa, bodal mowa, mao*, Kumaon; *Khusam*, Banda.

A small deciduous tree. *Bark* grey. *Wood* grey with a reddish tinge, moderately hard, even-grained, with very fine wavy interrupted concentric lines as in *E. spicata*. *Annual rings* faintly marked. *Pores* moderate-sized and large, mostly oval and subdivided, scanty, but more numerous than in *E. spicata*, irregularly distributed, marked on a longitudinal section. *Medullary rays* fine, uniform, equidistant, numerous, causing a satiny silver-grain on a radial section.

Lower Western Himalaya from the Chenab to Nepal, rising to 6000 ft.; Kalliangarh Hills of Banda (Brandis); Assam, Khasia Hills, the Shan Hills and the hill Eng forests of Martaban and Tenasserim up to 3000 ft.

A common, often gregarious, tree of the dry outer hills, locally very abundant, as in Malkot Pargana in the Dehra Dún and in other places in Garhwal and Kumaon. It may reach a girth of 4 to 5 ft. The leaves are used for cattle-fodder. The growth is fairly fast, 5 to 7 rings per inch of radius.

		lbs.
H 241.	Garhwal Hills (1868)	33
H 4819.	Malkot, Dehra Dún, 4000 ft. (Gamble)	35

ORDER CIII. MYRICACEÆ.

1. MYRICA, Linn.

One species only. In Europe, *M. Gale*, Linn. is the well-known Sweet Gale or Bog Myrtle, a small shrub of heath lands, especially in wet boggy places, with aromatic leaves. *M. cerifera*, Linn. is the Bayberry of the Eastern United States of America, a useful sand-binding plant; and *M. californica*, Cham. is the Californian Wax Myrtle or Bayberry of the Pacific Coast region. It is a small tree with a hard reddish-brown wood (Hough's "Amer. Woods," No. 164).

1. **M. Nagi**, Thunb.; Fl. Br. Ind. v. 597: Kurz For. Fl. ii. 475. *M. sapida*, Wall.; Brandis For. Fl. 495. *M. integrifolia*, Roxb. Fl. Ind. iii. 765. Vern. *Kaphal, kaiphal*, W. Him.; *Kobusi*, Nep.; *Dingsolir*, Khasia; *Sophi*, Sylhet.

A moderate-sized evergreen tree. *Bark* grey or brownish-grey, rough, with deep vertical wrinkles. *Wood* purplish-grey, hard, close-grained, apt to warp. *Annual rings* marked by a belt of firmer texture without pores in the autumn wood. *Pores* very small, uniformly distributed, but somewhat less numerous near the outer edge of each annual ring. *Medullary rays* fine and very fine, numerous.

Outer Himalaya, from the Ravi eastwards (I never saw it in Sikkim), at 3-6000 ft.; Khasia Hills and Sylhet; drier hill forests of Martaban at 4-6000 ft.

A tree of the drier aspects, usually, in the West Himalaya, found with the White Oak and Rhododendron. The wood is not used. The fruit is eaten; it is pleasantly acid, and is made into sherbet. The bark is the most valuable product of the tree; it is exported to the plains, used as an aromatic stimulant, and externally as a plaster against rheumatism. The bazars are supplied from North India, about 50 tons of the bark being annually collected in Kumaon (Pharmacog. Ind.). D. Hooper (*Amer. Jour. of Pharmacy*, May 1894) says that 100 parts of the "kino" produced by the bark contain about 61 parts of pure tannic acid. It is one of the best of Indian bark dyes, the colour produced being yellow. In their Report on it Messrs. Humnel and Perkin (Agric. Ledger, No. 6 (1897)) speak highly of its value. In the Khasia Hills it is used to poison fish.

		lbs.
H 87.	Sutlej Valley, Simla, 5000 ft.	46
H 426.	Jaunsar Forests, 5500 ft. (Bagshawe)	45
E 799.	Khasia Hills, about 5000 ft. (G. Mann)	52

ORDER CIV. CASUARINACEÆ.

1. CASUARINA, Forst.

The only genus of the Order. There are 23 species, chiefly of Australia and New Caledonia, one only extending to India. Several species are in cultivation in India, especially on the Nilgiris. Beddome mentions *C. stricta*, Ait.; *C. quadrivalvis*, Labill.; *C. paludosa*, Sieb. and *C. leptoclada*, Miq. *C. suberosa*, Otto et Dietr. is also grown and more commonly.

Wood light brown, brown, or reddish-brown, in concentric bands of light and dark tissue of irregular width. *Pores* moderate-sized, often in radial or oblique lines. *Medullary rays* of various breadth from extremely fine to very broad, the broad rays irregular.

1. **C. equisetifolia**, Forst.; Fl. Br. Ind. v. 598; Bedd. Fl. Sylv. ccxxvi.; Brandis For. Fl. 435; Kurz For. Fl. ii. 494; Talbot Bomb. List 198; Trimen Fl. Ceyl. 120. *C. muricata*, Roxb. Fl. Ind. iii. 519. The "Beefwood" of Australia. *Filao, bois de fer*, French. Vern. *Chouk*, Tam.; *Serva, chavuku*, Tel.; *Kásrike*, Mysore; *Tinyu*, Burm.; *Aru*, Malay.

A large evergreen tree. *Bark* brown, rough, fibrous, peeling off in vertical strips. *Wood* reddish-brown, very hard, cracks and splits. *Pores* moderate-sized, much subdivided, with white walls and partitions. *Medullary rays* very fine, uniform, equidistant. Numerous wavy, concentric lines of soft tissue joining the medullary rays and more or less in concentric arrangement.

Coasts of Chittagong and Burma; the Andaman Islands (very common on the coast of Little Andaman, but only in one spot, Casuarina bay, in Great Andaman—Prain); the Malay Archipelago, also in North Australia and Queensland. Cultivated all over India, except in the North-Western portion of the Punjab, and especially on the Coromandel and Kanara coasts.

The Casuarina, though indigenous only on the eastern coast of the Bay of Bengal, has become one of the important trees of India, chiefly from its capability of growing on coast sands close to the sea, and consequently taking, in the reclamation of sand-dunes, the place which is taken by the *Pinus maritima* on the French coast of the Bay of Biscay and by *Pinus sylvestris* on the coast of North Germany. The importance of the works of reclamation which have resulted in clothing with a belt of Casuarina very considerable lengths of the Coromandel coast from the Chilka Lake southwards and also much of the coast land of N. Kanara in the Bombay Presidency, cannot be over-estimated. It is true that the growth is short-lived, that natural reproduction is bad and artificial reproduction difficult; but once reclaimed by the aid of Casuarina, the coast lands get easily covered with shrubby and tree vegetation; and other trees, which would have been difficult to plant at first, can be easily brought in and a permanent forest constituted. Among such other trees are the Cashew nut

(*Anacardium occidentale*), the Nim (*Melia indica*), the Jaman (*Eugenia Jambolana*), the Karkapilly, the Palmyra palm and even the Coconut. The fine plantations made by private enterprise in the neighbourhood of Madras, and those of the Government at Tumalapenta, Dugarazpatam, Kottapatam, Tamminapatam and other places on the Nellore coast show well what can be done by the aid of this valuable tree in preventing the encroachments of sand-drifts and protecting the villages and their cultivated lands from destruction. Inland, also, Casuarina can be grown as a forest crop with much advantage as is abundantly shown by the plantations made in Mysore and in the North Arcot and other districts of Madras; while as a tree of ornament, planted in avenues and in gardens, the Casuarina may be seen with its graceful stems and foliage, in most of the stations of Northern India, at any rate as far as Saharanpur and Ambála.

A full account of the Nellore plantations of Casuarina is given in D. E. Hutchins' Report of 1883. There were then over 3000 acres of plantation, but the area has doubtless largely increased since then. Much of the planting was done *close*, *i.e.* 4½ ft. × 4½ ft., and in this Mr. Hutchins found the average yield to be 3 tons per acre per annum, while in *wide* planting 9 ft. × 9 ft. it was 7 tons. In coast sands, Casuarina requires that its roots should find fresh water at, at any rate, 6 to 10 ft. below the surface, so that watering is necessary for some years. Mr. Popert's "Note on Casuarina Planting" ("Ind. Forester," xxii. 8) gives information on all points. He says the average age of felling is 10 years; the average outturn is 50 tons per acre in Nellore (coast) and 28 tons in North Arcot (inland); seed is sown in nurseries usually in February, and the seedlings are put out usually 9 ft. × 9 ft. in September or October; watering is carried on for 3 to 4 years in dry months, but 2 years is usually enough; the cost per acre for completed plantations varies from Rs.32¼ in South Arcot to Rs.43 in Nellore, Rs.45 in North Arcot and Rs.109 in Trichinopoly; and at 10 years of age a plantation should give 40 tons per acre and a net return of Rs.38 per acre. The trees are usually cut clean and the area replanted, either with Casuarina again or with some other kinds. Casuarina coppices badly, but if cut at 2 to 3 ft. above ground it usually gives good shoots, while many of the trees layer naturally from lower branches. Self-sown seedlings are found only in favourable localities. Old trees are often much damaged by a fungus, *Polystictus egregius*, Massee; and frequently badly bored by longicorn beetles, of a species not yet determined.

The Casuarina wood of the Madras coast plantations is chiefly used for fuel, but some of it for poles and rafters. It is grown on so short a rotation that planking and other scantlings are not often obtainable, but in these respects even if the tree were grown to a larger size the timber could hardly compete with the excellent indigenous timbers brought from the natural forests. It was, however, recommended by such good authorities as Messrs. Chisholm, consulting architect, and Thorowgood, harbour-engineer, for wood-paving and other important uses, but it does not appear that their recommendations ever came to much. The wood is hard and difficult to work. Skinner, No. 42, gives W = 55 lbs. per cubic foot and P = 920. M. Sebert, in his "Notice sur les bois de la Nouvelle Calédonie," gives W = 63 lbs. Hutchins' careful experiments in Nellore give for green wood an average of 70 lbs., and he considers that the weight of dry wood is nearly 50 lbs. per cubic foot. He adds that in Mysore green wood is usually taken at 72 lbs., and seasoned wood at 52 to 56 lbs. It is probable that 50 lbs. is a good average for young wood, and 60 lbs. for wood of old trees. The bark is used by Madras fishermen for dyeing their nets.

		lbs.
E 2465.	Calcutta (G. King)	62
D 3908.	Dugarazpatam Plantation, Nellore (Gamble)	61
D 4024.	South Arcot (Wooldridge)	—

2. **C. suberosa,** Ott. and Dietr.; Benth. Fl. Aust. vi. 197. "Swamp Oak" of Australia.

A small tree. *Bark* very rough, dark brown, deeply cleft in narrow vertical clefts. *Wood* brown, hard, in alternate belts of brown large-celled tissue and pale small-celled tissue, the latter usually about double the breadth of the former. *Pores* small to moderate-sized, irregularly distributed. *Medullary rays* of two classes: irregular, often widely spaced, broad, very broad and even extremely broad rays of dark colour, with numerous regular very narrow ones between them.

Introduced into and planted in India, especially on the Nilgiris at 5–7000 ft. Indigenous in Australia.

This tree has been rather successful in some Nilgiri plantations.

	lbs.
W 4091. Bandy Shola Plantation, Nilgiris (Gamble)	49

Nordlinger's Sections, vol. 6.

3. **C. stricta**, Ait.; Benth. Fl. Aust. vi. 195; Brandis For. Fl. 435. "She Oak" of Australia.

A small tree. *Wood* light brown, hard, the usually pale cellular tissue traversed at intervals by concentric wavy or interrupted narrow, very narrow or extremely narrow bands of darker larger-celled tissue. *Pores* rather scanty, small to moderate-sized, arranged in radial or oblique lines and patches. *Medullary rays* of various classes from extremely fine up to broad, irregularly arranged.

Occasionally planted on the Nilgiris at 5–7000 ft. Indigenous in Australia.
Nordlinger's Sections, vol. 8.

ORDER CV. CUPULIFERÆ.

An Order of much importance, indeed of the greatest forest importance, in temperate climates, containing, as it does, such genera as those of the oak, beech, chestnut, hazel, hornbeam, birch and alder. In India, however, the trees which belong to it are confined to the Himalaya or to the mountain ranges of Eastern Bengal and Burma, no single species occurring in Southern India or Ceylon. There are six genera belonging to three tribes, viz.—

Tribe I.	Betuleæ	Betula, Alnus.
„ II.	Quercineæ	Quercus, Castanopsis.
„ III.	Coryleæ	Corylus, Carpinus.

and they contain in all 52 species, all trees.

Castanea vulgaris, Lam. (*C. Vesca*, Gaertn.) is the "Sweet Chestnut" or "Spanish Chestnut," found in almost all the countries bordering on the Mediterranean Sea, and extending eastwards through Northern Asia to Japan and westwards to North America, besides being largely cultivated in Northern Europe and elsewhere. It yields an excellent timber when grown as a large tree, while saplings and coppice shoots are largely used for hop-poles, cask-binding and other small industries. Its chief product, however, is its fruit, which in some countries, as in Southern France and Italy, is one of the chief food-articles of the people. Of recent years, many attempts have been made to introduce it successfully in the Himalaya as an assistance in supplying food to the villagers in times of scarcity, and much credit is due to Sir Edward Buck for his endeavours to this end (see Agricultural Ledger, No. 15 of 1894, and No. 4 of 1898). In some places it has succeeded fairly well, as at Dehra Dún, where there are trees of good size bearing good fruit in gardens at Chandbagh and Kaulagarh. But the fruit has not the same size or quality as that produced in Europe, nor does it keep well. It has also been grown at Ranikhet and Mukhtésar in Kumaon, at Simla, in Kulu, and near Darjeeling with different degrees of success. It seems that the most successful plantations have been those made at comparatively low levels, at 3–5000 ft. rather than at 5–7000 ft.; on northern rather than southern aspects; in fairly dry regions rather than in those of heavy rainfall, and on good soil rather than on poor lands, sandy soils being preferable to clays: see note by Sir E. C. Buck in Agric. Ledger, No. 4 (1898).

The beech, *Fagus sylvatica*, Linn. is the well-known European forest tree. Attempts have been made to grow it in the Indian hills, but unsuccessfully, the only specimen I can remember having seen being a poor small one in the Botanic Garden at Coonoor in the Nilgiris (Sim's Park).

Wood usually white, grey, or brown, rarely very dark in colour. *Annual rings* distinct in birch, alder, hazel and some of the oaks, indistinct in the rest. *Pores* of various sizes, and most usually in radial or oblique often branching groups or lines: in oak and chestnut

this character is very marked; it is seen in hazel, but is faintly perceptible only in the rest. In some oaks the pores become very large. *Medullary rays* fine, clear and regular, but in most genera broad rays (sometimes very broad) appear which are really compound and made up of closely packed fine ones. In birch and chestnut there are no broad rays. *Medullary patches* occur in some genera, especially in alder and hazel.

The *grain* of the wood of Cupuliferæ is somewhat characteristic: on radial sections a silver-grain is generally seen, varying in size of plate according to the thickness of the broad medullary rays, and the pores also adopt a characteristic pattern; on tangential sections the medullary rays make a pattern of oblong lenticular spots, and the pores also are somewhat marked.

Tribe I. BETULEÆ.

1. BETULA, Tourn.

Three Indian species. The common European Birch is *B. alba*, Linn., and the American Paper Birch, of whose bark the light, portable canoes are made in Canada, is *B. papyracea*, Willd.

Wood tough, close-grained, moderately hard. *Pores* small, not numerous. *Medullary rays* fine. *Medullary patches* scanty.

1. B. utilis, Don; Fl. Br. Ind. v. 599; Gamble Darj. List 79. *B. Bhojpattra*, Wall.; Brandis For. Fl. 457. The White Himalayan Birch. Vern. *Búrj, burzal, bhúj, phurz*, Pb.; *Bhoj*, Kashmir; *Shák, pád, phatak, takpa*, Ladak, Lahoul, Piti, Kunawar; *Bhúj*, Jaunsar; *Takpa*, Bhutia; *Bhújpattra*, Hind.; *Phuspat*, Nep.; *Súnli*, Lepcha.

A moderate-sized deciduous tree. *Bark* smooth, shining, reddish-white or white, with white horizontally oblong lenticels, the outer bark consisting of numerous distinct, thin, papery layers, peeling off in broad horizontal rolls. In these layers the lenticels appear as pink elongated oblong patches. *Wood* white with a pinkish tinge, tough, even-grained, moderately hard. *Annual rings* marked by a distinct line. *Pores* small, scanty, uniform and uniformly distributed, except that sometimes they are arranged in interrupted lines along the edges of the annual rings. *Medullary rays* fine and very fine, numerous, prominent on a radial section as a silver-grain of narrow reddish plates.

Higher ranges of the Himalaya, westwards to the Safed Koh (Aitchison in Kuram Valley at 11,000 ft.), eastwards to Bhutan, ascending to 14,000 ft., rarely descending below 10,000 ft., and usually with the silver fir or above it, the last tree met with at the limit of forest vegetation.

A beautiful tree, very conspicuous and often gregarious, but the bole is rarely straight, and only the upper branches show white bark, the thicker part of the bole getting rough and dark, as does that of the European birch. The growth is slow, with an average of about 15 rings per inch of radius. Reproduction is usually good where there is some immunity from the generally heavy grazing of the higher Himalayan regions. The average weight of the wood is about 44 lbs. per cubic foot; Wallich gave 35½ lbs.

The wood is extensively used in the inner arid Himalaya for building; it is elastic, seasons well and does not warp. The bark is very valuable; it is used as paper for writing and packing, for umbrellas, hooka-tubes, and for roofing houses. The branches are made into twig bridges, and the leaves are lopped for cattle-fodder.

			lbs.
H	909.	Upper Chenab, 10,000 ft. (Baden-Powell)	45
H	610.	Lahoul, 10,000 ft. (W. Pengelly)	44

		lbs.
H 126, 130.	Rotang Pass, Kulu, 9000 ft. (Col. Stenhouse)	42
H 127.	Monali, Kulu, 8000 ft. (Col. Stenhouse)	46
H 4527.	Chachpur Peak, Jaunsar, 10,000 ft. (Gamble)	47
E 381.	Tonglo, Darjeeling, 10,000 ft. (Johnston)	44
E 2403.	„ „ „ (Gamble)	43

2. **B. alnoides,** Ham.; Fl. Br. Ind. v. 599; Gamble Darj. List 79. *B. acuminata,* Wall.; Brandis For. Fl. 458, t. 56; Kurz For. Fl. ii. 476. Vern. *Páya udish, chambar máya, makshéri, sheori, shag,* Pb.; *Bhújpattra, háur, shául,* Hind.; *Kath bhúj,* Jaunsar; *Ūtis, sauer,* Garhwal; *Ban utis, payan utis, haoul,* Kumaon; *Shakshin,* Tibet; *Saver, sauer, payong, útis,* Nep.; *Hlosúnli,* Lepcha; *Dingleen,* Khasia.

A large deciduous tree. *Bark* grey, peeling off in horizontal rolls; lenticels large, oblong. *Wood* grey, light brown or white, moderately hard, close-grained. *Annual rings* marked by a line. *Pores* small to moderate-sized, larger than in *B. utilis*, scanty, evenly distributed. *Medullary rays* fine to almost moderately broad, short, much further apart and less numerous than in *B. utilis*, prominent on a radial section.

Himalaya, in the outer ranges, from the Sutlej eastwards, at 5–10,000 ft.; Khasia Hills at 3–5000 ft.; Kachin Hills, Shan Hills and hills of Martaban in Burma at 5–6000 ft.

This is the common birch of the Himalayan forests, so commonly seen at Simla, Chakrata, Darjeeling, etc. The growth is moderate, 10 rings per inch for wood from the North-West, 6½ rings for Darjeeling wood. Wallich says the wood is esteemed in Nepal for all purposes for which strength and durability are required, but in other parts it is very little used. The bark of old trees is often seen covered with a red fungus, *Hymenochæte Mougeotii,* Cke.

		lbs.
H 611.	Parbatti Valley, Kulu, 8000 ft. (W. Pengelly)	41
H 2904.	Nagkanda, Simla, 8000 ft. (Gamble)	41
E 2404.	Darjeeling, 7000 ft. (Gamble)	—

3. **B.** sp. *B. cylindrostachys,* Gamble Darj. List 79, *non* Wall. *B. alnoides,* Ham. (part); Fl. Br. Ind. v. 599. Vern. *Sauer,* Nep.; *Súnli,* Lepcha.

A tall deciduous tree. *Bark* pink, peeling off in large vertical flakes, giving the stem a shaggy appearance. *Wood* red, hard, heavy. *Annual rings* indistinct. *Pores* scanty, small, often subdivided, uniformly distributed. *Medullary rays* fine, numerous, the distance between the rays larger than the transverse diameter of the pores.

Darjeeling Hills from the Terai up to 6000 ft.

This reaches a large size, 80 to 100 ft. in height, with a girth of 6 to 8 ft. The growth is fast, 5½ rings per inch of radius. The wood is strong and seasons well, but is not used except for firewood and charcoal, for which purposes it is very good. It is a handsome tree with drooping branches, which requires further investigation as to its being distinct, as I strongly believe it to be, from *B. alnoides*. It is found even down in the Terai forests, along streams, in localities where it would be very unlikely that *B. alnoides* would occur. I think that, pending such investigation, it is best to keep it distinct, and more especially as the wood differs from that of *B. alnoides*.

		lbs.
E 678.	Bamunpokri, Darjeeling Terai (Manson)	52

2. ALNUS, Gaertn.

Two Indian species. The chief European Alders are *A. glutinosa,* Linn. with glutinous leaves, and *A. incana,* Willd. with pubescent leaves. The wood of both shows medullary patches.

Wood soft, light pinkish-brown. *Annual rings* well marked. *Pores* small to large; if large, much subdivided; otherwise in radial

lines. *Medullary rays* of two classes, very few broad with numerous fine ones between. *Medullary patches* scanty.

1. **A. nepalensis,** Don; Fl. Br. Ind. v. 600; Brandis For. Fl. 460; Kurz For. Fl. ii. 476; Gamble Darj. List 79. Nepalese Alder. Vern. *Kohi, koe,* Pb.; *Kúnch,* Bashahr; *Kuntz, ni, newn,* Sutlej; *Útis, udish, wústa,* N.-W. P.; *Útis,* Kumaon; *Pusála,* Jaunsar; *Kúnis,* Garhwal; *Boshi swa, udis, útis,* Nep.; *Kowal,* Lepcha.

A large deciduous tree. *Bark* thick, silvery grey, like that of the birch: in thick forest dark green. *Wood* light pinkish-brown, soft, even-grained. *Annual rings* marked by a poreless band. *Pores* small to moderate-sized and even large, the latter much subdivided, or else pores in rather long radial strings. *Medullary rays* of two classes, a few broad rays (made up of closely packed fine rays) at considerable intervals with numerous fine rays between them, the broad rays causing a marked silver-grain on a radial section, and ending in the cambium in a horny plate. *Medullary patches* few.

Forests of the Himalaya from the Ravi eastwards at 3–9000 ft., sometimes lower; Assam and the Khasia Hills; hills of Upper Burma.

A very fine tree, growing to an especially large size in the Sikkim Himalaya, and reaching 80 to 100 ft. in height with 6 to 8 ft. in girth. In that region it is especially common in old cultivated lands and near streams. In the West Himalaya also it affects ravines and the banks of streams, but not nearly to the same extent as does *A. nitida*, and it may sometimes be found in forests even in dry localities. The growth is fast: a round of Sikkim wood gave 2·4 rings per inch; Aikin, in Wallich's List, mentions two specimens, one giving 11·8 rings, the other 2·7 rings; the specimens examined showed 3·6 rings per inch.

The wood does not warp, and deserves to be more used than it is; it would do well for tea-boxes. Kanjilal says it is used for bedsteads and for the hooked sticks of rope bridges, in the Jumna-Tons valleys. The bark is used in dyeing and tanning.

The leaves are sometimes damaged and stripped from the tree by larvæ of the Scarabæid beetle, *Anomala viridis*, Fabr.

			lbs.
H	83.	The Glen, Simla, 6000 ft.	28
E	356.	Tukdah Forest, Darjeeling, 5000 ft. (Johnston) . . .	27
E	2405.	" " (Gamble)	—

2. **A. nitida,** Endl.; Fl. Br. Ind. v. 600; Brandis For. Fl. 460, t. 57. Vern. *Gíra,* Afg.; *Sarol, selang,* Kashmir; *Shrol, saroli, sawáli, rikunra, chámb, chápu, piák, kúnsa, kúndash, niú, kosh, raján,* Pb.; *Kuntz, ni, newn,* Sutlej; *Útis, kúnis,* Jaunsar; *Paya udesh,* Kumaon.

A large tree. *Bark* brown, rough, with deep furrows. *Wood* reddish-white, soft, close- and even-grained, tough to cut. *Annual rings* distinctly marked by harder wood near the inner edge of each ring. *Pores* small, numerous, uniformly distributed, arranged in radial lines. *Medullary rays* of two classes, a few broad rays at considerable intervals with numerous fine rays between them; the broad rays (really closely-packed small rays) marked as irregular shining plates in the silver-grain. *Medullary patches* scanty.

Western Himalaya, from Kashmir to Kumaon, descending to the plains, and ascending to 9000 ft., but most commonly at 2–4000 ft., always along rivers and streams.

In the Fl. Br. Ind. this tree is said to reach 100 ft. in height and 15 ft. in girth of trunk. I have never seen it so big, but as Brandis is the authority, the statement is doubtless correct. It is usually rather crooked, and branches early. Brandis says the wood is used for bedsteads and the hooked sticks of rope bridges, and that the twigs are tough, and used in making bridges and tying loads. The bark is used in dyeing and tanning. An attempt was recently made to float out pieces of the wood from the Tons river forests, but failed, as the wood quickly got waterlogged.

		lbs.
H 119.	Vaziri Rupi, 6000 ft. (Col. Stenhouse)	28
H 147.	Sainj, Simla, 4000 ft.	31

TRIBE II. QUERCINEÆ.

3. QUERCUS, Linn.

Oaks. A large genus, one of those of most forest importance, not only in India and in Europe, but also in North America, Japan and other parts of the world. It contains about 300 species, of which 31 are found in India and Burma. These 31 belong to 6 subgenera.

The most important of the non-Indian oaks are described in Brandis For. Fl. pp. 483 to 487, and in other works such as Mathieu's "Flore Forestière;" it is only necessary, therefore, to say that the British oaks are *Q. pedunculata*, Ehrb., and *Q. sessiliflora*, Sm., usually united by botanists under the name *Q. Robur*, Linn. The Cork oak is *Q. Suber*, Linn., found throughout the Mediterranean region; and cork is also produced by *Q. occidentalis*, Gay, of Spain, Portugal and Western France. The Vallonea oak of Syria and Asia Minor, whose acorns are so largely used for tanning and dyeing, is *Q. Ægilops*, Linn. The Cork oak has been tried, but unsuccessfully, in the Himalaya, and the common oak has been grown here and there in gardens, but does not do well. The best specimens are probably those to be seen in gardens, public and private, on the Nilgiris. The Turkey oak of Europe is *Q. Cerris*, Linn. The Red oak of North America, much planted in European gardens, is *Q. rubra*, Linn.

Wood brown, very hard to extremely hard, heavy, generally with a distinct, darker-coloured heartwood, and generally with alternate concentric dark and light belts, the latter the harder. *Pores* small to large, arranged in irregular radial lines or elongated patches. *Annual rings* very indistinct, and not marked as in the case of European oaks, by a belt of larger pores in the spring wood (*Q. Griffithii* and *Q. serrata* are an exception to this). As regards the *medullary rays*, two types may be distinguished. In the first type (*Q. pachyphylla*, *fenestrata* and *lappacea*) there is only one class of medullary rays, all being very fine, very numerous, uniform and equidistant. The other species have two classes, namely, besides the very fine rays already described, a small number of broad, or very broad, rays, which are really composed of many small ones close together.

First Group.—All medullary rays very fine, very numerous, uniform and equidistant. Wood seasons well, does not warp or crack.

Second Group.—Medullary rays of two classes, very fine and broad, the latter very prominent on a vertical section, making a silver-grain of rather large plates. The wood of most Indian species warps and splits in seasoning.

SUBGENUS 1. LEPIDOBALANUS.

Seven species.

1. Q. semecarpifolia, Smith; Fl. Br. Ind. v. 601; Brandis For. Fl. 479, t. 64. Vern. *Barchar, jangal ka parúngi*, Jhelum; *Kreu, khareu, krúi*, Chenab, Ravi; *Karshu, karsúi, karzu, sáuj*, Sutlej to Sarda; *Ghesi, kasru*, Nep.

A large evergreen tree. *Bark* dark grey, rough, with small quadrangular scales, and often with protuberances arranged in horizontal lines. *Wood* very hard, close-grained: sapwood greyish-white; heartwood light pinkish-brown; cellular structure in more or less regular, wavy, interrupted, concentric alternate bands of lighter, looser and darker, closer texture; the width of each about equal. *Annual rings* only recognizable in young trees or coppice shoots, and there marked

by a line without pores. *Pores* in more or less radial groups, branching outwards and forming a curious and pretty network. *Medullary rays* of two classes: few broad (made up of closely packed fine ones) at irregular intervals, separated by numerous uniform, regular, and equidistant, very fine. Silver-grain not conspicuous, but characteristic.

Inner Himalaya, throughout, extending westwards to the Safedkoh and Afghanistan, eastwards to Bhutan, usually at 8–12,000 ft.; hills of Manipur.

The "Karshu" oak, recognizable by its brownish foliage, is characteristic of a zone of elevation, where it is the principal tree and grows gregariously in extensive forests. This zone begins practically where that of the "Moru" oak (*Q. dilatata*) ends, the two only very slightly overlapping. The elevation of the lower limit of Karshu is 8000 ft., but it is not really in its best form below 8500 ft. Aitchison says that in the Kuram District, "I measured one 18 ft. in circumference, with the trunk '100 ft. before it divided. It had been cut down by the Afghan army just before our 'occupation." He gives its limits as 9–11,000 ft. for Kuram and Hariáb. In exposed places, on high ridges about 10,000 ft., it is usually quite a small tree with branches laden with mosses (*Meteorium*, etc.) and lichens (*Usnea*, etc.), which are especially noticeable on southern aspects where the monsoon rainclouds surround them. On northern aspects and in sheltered places it becomes a very large tree, and may reach a height of 80 to 100 ft., with a girth of 12 to 15 ft. The Karshu forests may often be seen in a condition suggesting coppice growth, and this may be really due to previous bad treatment, though its cause is not accurately known. The growth is slow, 10 to 15 rings per inch of radius; in what were apparently coppice shoots I have found it as fast as 5 to 6 rings, but this is quite exceptional. It is distinctly a light-demanding species, and if treated in High Forest, seed-fellings have to be made heavy, and the ground to be well worked up if good reproduction is to be obtained. Good seeding years occur at somewhat irregular intervals, but when they do occur the amount of acorns produced is enormous, and where they can reach the soil, and are neither eaten by bears, squirrels and other animals, nor choked by prolific ground vegetation, the young crop they produce is dense and complete. The growth of seedlings is very slow at first, but when once a good leader is formed, it becomes quicker. Propagation by seed-sowing usually gives better results than transplants, especially if the soil can be well worked up; but it is distinctly difficult, and though the seed usually germinates well, the seedlings often die off unaccountably. Treated in coppice Karshu grows fairly well only, and the rotation has to be a somewhat long one. In forests worked for fuel the Karshu is a very important tree.

The timber is not much used, that of the deodar, firs and pines, which generally are found in the same region, being preferred for construction; but it is of good quality, and where carriage is easy and cheap, it should be more employed on account of its strength and durability. It is an excellent firewood, and gives charcoal of the best description. Dr. Leather found the calorific power of the wood 93 as compared with pure carbon 100. He found ordinary dry wood to give 92 per cent. carbon and organic matter, 2 per cent. ash and 6 per cent. moisture. The leaves are used for fodder and employed as litter. The bark has been experimented on as a tanning material, but is poorer than that of "Ban" (*Q. incana*), and not worth collecting for the purpose. The leaves have been found suitable for feeding the caterpillars of the silk-moth, *Antheræa Pernyi*, introduced from China and reared in Jaunsar in 1898. Old trees are much attacked by a fungus, whose sporophores have not yet been found, but from the appearance of the mycelium-filled wood and the black flat rhizomorphs, it would seem to be *Agaricus melleus*, Vahl, or some allied species (see "Ind. Forester," xxv. 434).

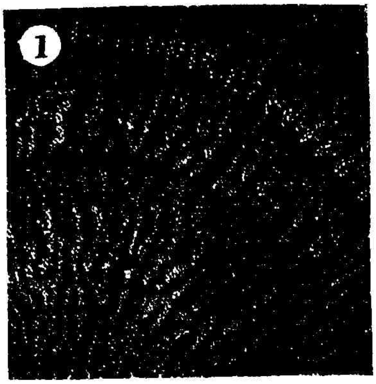
		lbs.
H	39. Mahasa, Simla, 9000 ft.	54
H	72, 2893. Nagkanda, Simla, 9000 ft. (Gamble)	53
H	4709. Deoban, Jaunsar, 9000 ft. (Gamble)	56

The latter specimen from a coppice shoot.

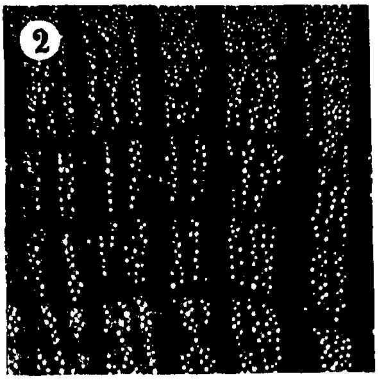
Nordlinger's Sections, vol. 8 (Tab. XIV. 1).

No. E 2464, sent by Dr. Schlich from the Valley of Chumbi, Tibet, between Sikkim and Bhutan, is a tree, the leaves of which resemble those of *Q. semecarpifolia*, but are smaller and less tomentose beneath. The *wood* is light-coloured, the *pores* small, surrounded by soft tissue, in long, radial anastomosing bands. The wood resembles that of *Q. Ilex*, which or near which species it probably is.

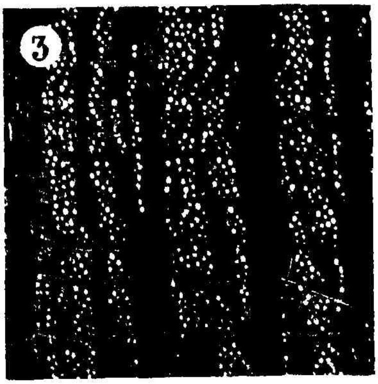
XIV.



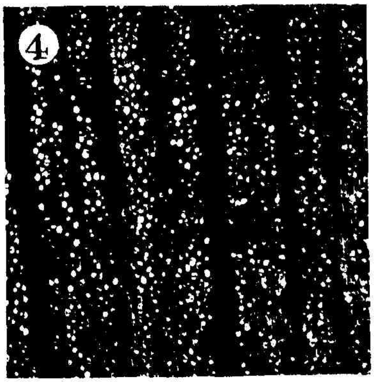
QUERCUS SEMECARPIFOLIA.



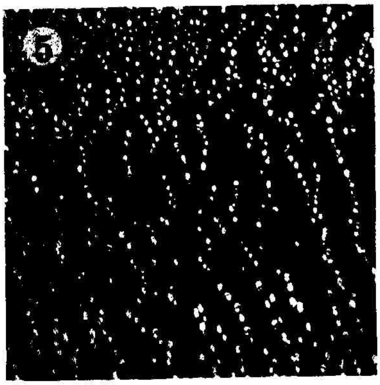
Q. DILATATA.



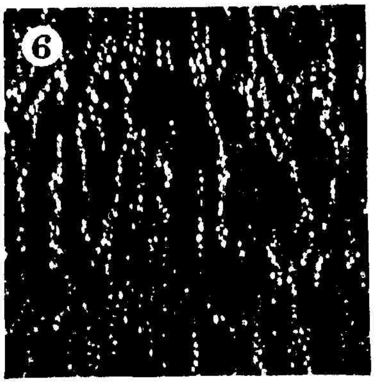
Q. INCANA.



Q. LAMELLOSA.



Q. LAPPACEA.



Q. LANCEÆFOLIA.

(*Magnified* $3\frac{1}{2}$ *times.*)

2. **Q. serrata,** Thunb.; Fl. Br. Ind. v. 601; Brandis For. Fl. 486. Vern. *Dingrittiang*, Khasia.

A moderate-sized deciduous tree. *Bark* ¾ in. thick, very rough, with deep irregular vertical fissures, dark greyish-brown, granular. *Wood* dark greyish-brown, very hard, with faint, alternate, concentric, wavy and interrupted belts of light-coloured open, and dark-coloured close, cellular tissue, the latter about double the width of the former. *Annual rings* prominently marked by a belt of large or very large pores in the spring wood. *Pores* in the spring wood as above, thence gradually decreasing in size, and more and more scanty in long straight or oblique streamers surrounded by pale loose tissue. *Medullary rays* of two classes, fairly numerous, broad compound rays (10 to 15 per inch) alternating with many very numerous, and regular fine ones. The broad rays give a conspicuous silver-grain on a radial section.

Eastern Himalaya and Khasia Hills at 3–5000 ft.; Manipur; Shan Hills of Burma at 5000 ft.; Japan.

A handsome species, straight-stemmed and quick-growing. It has been largely planted at the Cinchona Plantations near Darjeeling, and succeeded admirably, but I never saw it wild in Sikkim. It has also been planted about Dehra Dún, also very successfully: its cultivation deserves to be extended. A round cut from a tree felled in the garden of the Imperial Forest School shows a growth of 2 to 3 rings per inch of radius. The timber is used for building purposes in Assam.

		lbs.
E 3339.	Shillong, Assam, 5000 ft. (Mann)	—
O 4579.	Forest School Garden, Dehra Dún (cult.)	58

3. **Q. dilatata,** Lindl.; Fl. Br. Ind. v. 602; Brandis For. Fl. 482. Vern. *Záih*, Kafiristan; *Bán, banji, banchar, barachar, baráin, banni, parúngi, chora, káli ring, múru, máur, moru, marghang, karsh*, Pb.; *Moru, tilangsa, timsha*, N.-W. P.; *Kilonj*, Kumaon; *Tilonj*, Garhwal; *Ramshing*, Byáns.

A large, nearly deciduous, tree. *Bark* dark grey, almost black, often with horizontal cracks, peeling off in longitudinal scales. *Wood* very hard: sapwood grey; heartwood reddish-grey with darker streaks; with alternate, very faint belts of light-coloured loose and dark-coloured close texture, the latter the broader. *Annual rings* marked by a dark line. *Pores* small or moderate-sized, scanty, in long radial or oblique ramifying patches between the broader medullary rays. *Medullary rays* of two classes; the very broad ones fairly numerous; the fine ones very numerous, uniform and equidistant, between them.

Inner Himalaya, extending westwards to Afghanistan and the Safedkoh, and eastwards to Nepal, usually at 7–9000 ft.

The "Moru" oak, recognizable by its shining green foliage, occupies the forest-belt below that of the "Karshu," and above or running into that of the "Ban." While the latter, however, prefers dry exposed spurs and ridges, the "Moru" seems to prefer ravines and moist forests with the spruce and silver fir as its most frequent associates. Like the other two, "Moru" is also frequently gregarious, and sometimes reaches a very large size. Brandis mentions 80 to 90 ft. in height, and a girth of 8 to 9 ft., and even 15 to 18 ft.; but I have seen trees taller than 100 ft. in various places in Jaunsar and Tehri-Garhwal. Moru reproduces very well from seed, and the seedlings can endure rather more shade than the other two common species, though, if they are to grow well afterwards, they require to be given light at an early stage. Dense thickets of seedlings are frequently seen in the neighbourhood of old trees. It coppices well also. Artificial reproduction by means of transplants is easy in suitable spots, as may be seen in the small Matkaugra plantations near Chakrata. The growth, so far as is known, is moderately fast. In the Working Plan of the Naini Tál Municipal Forests, 1895,

by F. B. Bryant, the exploitable age is fixed at 160 years, corresponding to a girth of 6½ ft.

The wood is durable, and used for building, agricultural implements, axe-handles and jampan poles (Brandis); in the Tons Valley sleeper works, it is the best wood for making the runners of the sledges used in the extraction of the deodar timber. It has a good grain if properly cut, but does not season well, being rather apt to warp and shrink. The wood weighs about 61 lbs. per cubic foot. It is a good fuel. Dr. Leather found its calorific power 91 as compared with carbon = 100, but it gave 5·55 per cent. ash as compared with the 2·3 given by Karshu. Major Lang gives P = 670. The leaves are very much lopped for fodder in open forests near villages. The bark has been tried for tanning, but is much poorer than "Ban," which see. Old Moru oaks have been sometimes found attacked by a fungus, *Stereum lobatum*, Kunze.

		lbs.
H 935.	Hazara, 8000 ft. (Baden-Powell)	61
H 4.	Mahasu, Simla, 8000 ft.	56
H 40.	Mahasu, Simla, 8000 ft.	69
H 2845.	Mahasu, Simla, 8000 ft. (Gamble)	58
H 2873.	Nagkanda, Simla, 9000 ft. „	—
H 777.	Kalatop Forest, Punjab, 7000 ft. (Pengelly)	—

Nordlinger's Sections, vol. 7 (Tab. XIV. 2).

4. Q. Ilex, Linn.; Fl. Br. Ind. v. 602; Brandis For. Fl. 480. The Holm oak. *Chêne Yeuse*, Fr.; *Leccio*, Ital. Vern. *Charrei, serei, balút*, Afg.; *Spercherei, pargái, kharanja*, Trans-Indus; *Chúr, kcharsu, kharen irri, yúru, heru, ban, bré, brekcke*, Pb.

A moderate-sized evergreen tree. *Bark* ¼ in. thick, dark grey, tessellated, and cut into quadrangular plates. *Wood* very hard: heartwood red or reddish-brown, durable, with very fine, wavy, concentric rings of loose tissue alternating with broader bands of firmer texture. *Pores* small to moderate-sized, scanty, in long, irregular, anastomozing, radial bands. *Medullary rays* of two classes; few broad or very broad rays, separated by numerous, regular, uniform and equidistant, very fine rays.

Inner West Himalaya, extending westwards to Afghanistan and the Suliman Range, eastwards to Kumaon, at 3–8000 ft.; westwards to the Atlantic.

The evergreen oak is scarcely an Indian forest tree of importance, as it is chiefly found only in the inner dry region, beyond the reach of the monsoon rains. It is usually gregarious, though more or less mixed with other trees, especially the wild olive.

Growth slow, rings uncertain; if the concentric lines in No. H 1406 are annual rings, the growth of that specimen was 70 rings in 4 in. of radius. In 1880, in a small forest in the Spingawai Pass in the Kuram Valley, Mr. Bagshawe counted the rings of eight trees. These trees averaged 85 in. in girth, with an average number of 270 rings, or nearly 20 rings per inch of radius. Weight: that of the European tree varies between 60 and 69 lbs. per cubic foot; the three specimens examined give an average of 61 lbs., but the third was old wood, having been cut in 1867. Mathieu Fl. For., p. 374 gives the weight as varying from 55 to 74 lbs. per cubic foot. The wood warps and twists, but when well seasoned it works admirably, and takes a fine polish. Aitchison says that the wood gives a good fuel in the Kuram Valley even when green. It is largely used for tool-handles, and pieces are brought from the Suliman Range for that purpose. It is used for agricultural implements, and yields good fuel and charcoal. The branches with prickly leaves are used for fencing, and those without prickles are stored for winter cattle-fodder. The acorns (probably var. *Ballota*, Desf.) are eaten in France, Spain and Portugal, and the bark is considered of good quality for tanning.

		lbs.
H 903, 953.	Upper Sutlej Valley, 8000 ft. (Baden-Powell)	62 and 68
H 1406.	Suliman Range (Stewart, 1867)	54

Nordlinger's Sections, vol. 3.

5. Q. Griffithii, Hook. f. and Th.; Fl. Br. Ind. v. 602. Vern. *Dingim*, Khasia; *Metlein*, Ruby Mines, Burma.

A large deciduous tree. *Bark* black, with deep vertical fissures. *Wood* brown, very hard, with numerous fine, parallel, wavy, transverse lines. *Annual rings* marked by a belt of large pores in the spring wood. *Pores* small to moderate-sized, large in the spring wood, gradually decreasing outwards, enclosed in patches or radial wavy branching groups of soft tissue. *Medullary rays* of two classes: numerous, fine, uniform and equidistant rays and few broad to very broad rays.

Khasia Hills at 5–6000 ft.; Manipur; Shan Hills and other hills of Burma: cultivated in the Sikkim Himalaya.

This is the one of the Indian oaks which most nearly resembles, in appearance and structure, the *Q. Robur* of Europe. Its growth is fast, and it has been successfully cultivated as a fuel tree at the Cinchona Plantations of Mongpu near Darjeeling, along with *Q. serrata*. Is seems certainly to deserve more attention as giving an excellent wood and being easily treated in forest. The timber is used for building and other purposes in the Khasia Hills.

E 3337. Shillong, Khasia Hills, 5000 ft. (G. Mann).

6. **Q. lanuginosa**, Don; Fl. Br. Ind. v. 603; Brandis For. Fl. 481. Vern. *Banj, rianj, rai banj*, Kumaon; *Kiani*, Garhwal; *Banga*, Nep.

A large, evergreen tree. *Bark* ¼ in. thick. *Wood* greyish-brown, very hard, with many wavy, concentric lines. *Pores* moderate-sized, in radial strings, scanty. *Medullary rays* of two classes, the broad rays prominent on a vertical section, giving the wood a handsome silver-grain.

Naini Tál and a few other places in Kumaon, between 6000 and 7500 ft., extending eastwards to Bhutan. Gregarious, or associated with *Q. incana*.

Growth, annual rings not sufficiently recognizable for certainty, but if the lines on No. 2968 are annual rings, the growth is moderate, 7 rings per inch of radius. The wood is used for firewood, the leaves for cattle-fodder. Fernandez, in his Naini Tál Working Plan, 1888, points out that the *rianj* tree likes a soil which contains lime and grows in patches, affecting cool protected aspects.

	lbs.
H 2968. Naini Tál, 7000 ft.	55

7. **Q. incana**, Roxb. Fl. Ind. iii. 642; Fl. Br. Ind. v. 603; Brandis For. Fl. 482. White oak. Vern. *Vari*, Salt Range; *Rhin*, Hazara; *Rinj, rin*, Jhelum; *Bán, banj*, Pb.; *Banj*, Kumaon; *Kharanj, tikia banj*, Dotiál.

A large evergreen tree. *Bark* dark coloured, brown or greyish-brown, rough, with irregular fissures, silvery when young, peeling off in rounded flakes. *Wood* very hard, reddish-brown, warps and splits; with alternate very faint concentric belts of light loose and dark compact tissue. *Annual rings* indistinct. *Pores* small and moderate-sized, scanty, in radial extended, irregular, usually oblique patches between the broader medullary rays. *Medullary rays* of two classes: few extremely broad (5 to 6 per inch) alternating with numerous very fine uniform and equidistant rays; the broader rays giving a very conspicuous silver-grain on a radial section.

Himalaya, from the Indus to Nepal at 2000 (Dehra Dún) up to nearly 8000 ft.; Shan Hills of Burma.

The "Ban" is probably the best known of the Himalaya oaks; it is found as one of the most common trees near the hill stations of Simla, Mussoorie, Naini Tál, etc., and is at once recognized by its grey foliage. It is more or less gregarious, growing usually in association with *Rhododendron arboreum*, *Pieris ovalifolia*, and a few other species, also occasionally the deodar; and forming the chief tree of a well-known class of forest. As it prefers rather dry hillsides, it runs often above the lower limit of the "Moru," which affects the ravines, but it descends much lower, and may be

found even right down to 2000 ft., as in the Motronwala Forest in Dehra Dún, its most usual lower limit, however, being 5000 ft. The forests of Ban oak are mostly treated in coppice, and in some parts of the Government Reserves they are in process of conversion into deodar, for the deodar can be planted or sown under the protection of the Ban oak, and will grow up through it, when the oak can be girdled and allowed to die or be felled. In some cases they are treated in simple coppice with standards of coniferous trees, deodar, blue pine or long-leaved pine. The Ban oak forests, however, form one of the chief grazing grounds of the hill villagers, and the custom of annual firing damages the trees and prevents reproduction. Wherever protected from fire excellent grazing can be obtained for a number of cattle within reasonable limits, without such damage, and with a considerable yield in firewood replaced by fair seed and coppice reproduction. Some forests of Ban oak are regularly treated for lopping for litter and fodder for cattle in the winter. Such a practice would of course be impossible with a valuable timber tree, but is quite possible with a fuel tree, provided that the lopping is not too carelessly done, and that ordinary necessary precautions like the care of the leading shoot, are observed. Ban oak can be reproduced artificially, either by transplants or by sowing the acorns, but care must be taken to dibble these irregularly, and, if possible, watch them, for the acorns are much sought for as food by bears, monkeys, rats, squirrels, etc., as well as by birds of many kinds. It is owing to this circumstance that, in spite of very profuse seeding, natural reproduction is not good unless the ground has been well worked, so that the acorns can get covered with soil and hidden.

In the Working Plan for the Naini Tál Municipal Forests by F. B. Bryant, the exploitable age, equally with Moru, is fixed at 140 years, corresponding to 6½ ft. in girth.

The wood is scarcely used for timber, as it warps and splits badly and is rarely straight, but it is used occasionally both in building and for agricultural implements. Its chief use is as fuel, for which purpose it is important all through the West Himalaya, both as firewood and as charcoal. Dr. Leather found the calorific power 90·8 against 100 for pure carbon; his analysis gave 91·80 per cent. of carbon and other organic matter, 4·75 per cent. of moisture, and 3·95 per cent. of ash. Dr. Warth's experiments gave, however, only 0·62 lb. of ash in 100 lbs. steam-dry wood, 0·25 of this being calcium carbonate and 0·16 magnesium carbonate. The weight is about 64 lbs. per cubic foot; Major Lang found P = 491. As already stated, the leaves are much used for fodder.

The growth is fairly fast; on young trees and coppice shoots the rings can be counted, and well-grown specimens give about 6 rings per inch of radius.

The bark has been experimented on as a tanning material by Prof. Trimble (see D. Hooper in *Ind. Agrt.*, April 1, 1895), at the same time as that of the other oaks of the N.-W. Himalaya. The result was as follows:—

	Tannin in air-dried bark.	Moisture.	Tannin in dry bark.	Ash in dry bark.
Q. annulata	11·37	6·85	12·20	11·30
Q. dilatata	7·40	6·88	7·94	10·02
Q. incana	22·12	5·31	23·36	11·06
Q. semecarpifolia	7·99	7·04	8·60	10·88

Mr. Hooper says that the Ban oak gives a larger percentage of tannin than the European or American oaks do.

			lbs.
H	899.	Murree, 7000 ft. (Baden-Powell)	62
H	171.	Kangra, 6000 ft. (Stewart, 1867)	—
H	1, 24.	Simla, 7000 ft.	67 and 66
H	2867.	„ „ (Gamble)	—
H	2.	Mahasu, Simla, 7000 ft.	—

Nordlinger's Sections, vol. 7 (Tab. XIV. 3).

SUBGENUS 2. CYCLOBALANOPSIS.

Nine species. *Q. oidocarpa*, Korth., *Q. Brandisiana*, Kurz, *Q. mespilifolia*, Wall., *Q. Helferiana*, A. DC and *Q. velutina*, Lindl. are all Burmese trees, the last-named extending north to Chittagong, and some of them to the Shan Hills.

8. Q. semiserrata, Roxb. Fl. Ind. iii. 641; Fl. Br. Ind. v. 604; Brandis For. Fl. 488; Kurz For. Fl. ii. 488. Vern. *Thitcha,* Burm.

An evergreen tree. *Wood* hard: sapwood reddish-grey, heartwood reddish-brown. *Pores* small to moderate-sized, often subdivided, rather scanty, irregularly scattered, but roughly showing small radial or oblique strings. *Medullary rays* fine only, no broad ones, regular, numerous, silver-grain of narrow horizontal plates. *Annual rings* marked by darker autumn wood with fewer pores.

Assam, Khasia Hills, Sylhet and Cachar up to 3000 ft.; Eng forests throughout Burma.

It is curious that this species should be devoid of broad medullary rays, but I cannot suppose that Sir D. Brandis' specimen is wrongly named. Kurz says that the wood weighs 48 lbs. per cubic foot, and is used for the pins that join together the parts of Burmese cart-wheels.

Burma—Kew Museum (Brandis).

9. Q. glauca, Thunb.; Fl. Br. Ind. v. 604. *Q. annulata,* Smith; Brandis For. Fl. 487, t. 65. Vern. *Brán, brén, barin, banni, imbri, indri,* Pb.; *Inai, báni,* Jaunsar; *Phanat,* Garhwal; *Pharonj, phanyat, phaliant, paliyat,* Kumaon; *Phalat,* Nep.; *Sagat, metlein,* Burm.

An evergreen tree. *Bark* $\frac{1}{6}$ in. thick, grey, smooth. *Wood* very hard, grey or greyish-brown, with numerous fine wavy concentric bands. *Annual rings* indistinct. *Pores* moderate-sized and small, in irregular radial lines or groups. *Medullary rays* of two classes: few broad and very broad rays with numerous, uniform, equidistant very fine rays between them, the broad rays showing as a marked silver-grain of broad plates on a radial section.

Himalaya, from Kashmir to Bhutan at 3-6000 ft., most common in the valleys of the Garhwal and Kumaon Hills, less so in Sikkim; Khasia Hills at 2-4500 ft.; Shan States and Katha in Burma.

The "Inai" oak is not properly gregarious, but is frequent, chiefly along the banks of streams with laurels and other evergreen trees. The acorns are pointed with a conspicuous apex and a small thin-ringed rather deep cup. The wood is little used, but has been found useful in Jaunsar for sledge-runners equally with that of *Q. dilatata.* It weighs about 58 lbs. per cubic foot.

			lbs.
H	927.	Hazara, 6000 ft. (Baden-Powell)	55
H	90.	Bhajji, Simla, 4000 ft.	62
H	423.	Raulagadh, Chakrata, 9500 ft. (Bagshawe)	57

10. Q. lineata, Blume; Fl. Br. Ind. v. 605; Gamble Darj. List 80. Vern. *Phalat,* Nep.; *Siri,* Lepcha.

A large evergreen tree. *Bark* brown, thick, rough. *Wood* brown or greyish-brown, very hard, with well-marked alternate concentric wavy bands of pale close and dark open tissue, the latter very narrow. *Annual rings* indistinct. *Pores* small to very large in radial branching lines or groups between the broad medullary rays. *Medullary rays* of two classes: fairly numerous very or extremely broad rays, with very numerous uniform equidistant very fine ones between, the broad rays making a marked silver-grain of broad plates on a radial section.

Eastern Himalaya from Nepal eastwards, usually at 6-9000 ft.; Khasia and Naga Hills at 5-6000 ft.; hills of Arracan; Shan States.

This is the second of the important Darjeeling oaks; it has generally been called *Q. annulata* (see Ed. 1, p. 387), but, according to King, it seems clear that the common Phalat which has a depressed acorn in a somewhat broad shallow cup is this species, while the true *Q. annulata,* i.e. *Q. glauca* of the Fl. Br. Ind., has a pointed acorn and

narrow deep cup, and is found much lower down. It is a constant companion of the Búk (*Q. lamellosa*) and its wood is used almost indifferently with that of that species, though it is not considered quite so good, and is more liable to warp and crack. Its natural reproduction is not very good, but it is not difficult to rear artificially. It demands the same treatment as is accorded to Búk.

		lbs.
E 433.	Rangbúl Forest, Darjeeling, 7000 ft. (Johnston)	60
E 2451.	" " " " (Gamble)	69
E 3609.	Darjeeling, 7000 ft. (Gamble)	—

Nordlinger's Sections, vol. 8 (*Q. annulata*).

All these probably belong to var. *Thomsoniana*, Wenzig.

Nos. E 1439, 1443 Mishmi Hills (Griffith, 1836) most probably belong to this species.

11. Q. lamellosa, Smith; Hook. f. Ill. Him. Pl. t. 20; Fl. Br. Ind. v. 606; Brandis For. Fl. 488; Gamble Darj. List 80. Vern. *Shalshi, pharat-singhali, budgrat*, Nep.; *Búk*, Lepcha.

A very large evergreen tree. *Bark* greyish-brown, 1/3 to 1/2 in. thick, rough. *Wood* very hard; heartwood greyish-brown, concentric wavy lines indistinct. *Annual rings* not distinct. *Pores* small to large, less scanty than in the woods of Subgenus 1, in more or less radial groups or strings, often oblique, several between each pair of broad medullary rays. *Medullary rays* of two classes: few broad to extremely broad (about 8 to 9 per inch), with numerous rather short, fine, uniform ones between them; these are bent round the pores. The broad rays show, on a radial section, a very prominently marked silver-grain of broad plates, and on a tangential section broad oblong lenticular patches.

Eastern Himalaya from Nepal to the Duphla Hills at 5–9000 ft.; hills of Manipur at 7–8000 ft.

This is the finest and most important tree of the forests of Darjeeling. It grows to a very large size, reaching, occasionally, 100 to 120 ft. in height, with 30 to 40 ft. to the first branch, and 15 to 20 ft. and even 30 ft. in girth, but old trees are often hollow or decayed in the centre. The acorns are very large, the cups often 2 to 3 in. in diameter, and composed of broad annular rings. The leaves are large, hard, and parallel-veined. Natural reproduction is not good, perhaps because the soil is often insufficiently worked up and the cover too heavy for good growth. In nurseries the acorns germinate well, though they often take a long time; seed is, however, not always obtainable, good seeding years only occurring at intervals. Manson says: "The reproduction of búk is most satisfactory where the soil is rich and light, where 'there is no grazing, and especially on ridges or where the forest is open or the cover '(canopy?) particularly lofty." He thinks that seedlings are most usually found under the shelter of a boulder, stump or fallen tree, and probably come from seeds which have escaped the notice of the squirrels. He also thinks that seedlings thrive better in company with the *Maling* bamboo (*Arundinaria racemosa*) than elsewhere. It has been settled that in the búk forests, a rotation of 160 years is the best one to adopt, but for the present and to introduce more uniformity the system of working is to be by "amelioration-fellings." The rate of growth is probably about 8 to 12 years per inch of radius, but as the annual rings are usually indistinct and doubtful, it is difficult to determine this accurately.

The timber is durable if not much exposed to wet; it is used for posts and beams in the construction of houses and bridges, and for door-posts, window-frames and rafters. It is an excellent fuel. It also splits well and can be used for shingles, though it is inferior for this purpose to the woods of *Q. pachyphylla* and of the chestnuts. The bark is used for tanning in Darjeeling. The average weight of the wood is about 59 lbs. per cubic foot.

		lbs.
E 434.	Rangbúl Forest, Darjeeling, 7000 ft. (Johnston)	63
E 2452, 2453.	Rangbúl Forest, Darjeeling, 7000 ft. (Gamble) .	59 and 57
E 1438, 1448.	Mishmi Hills (Griffith, 1836)	57 and 59

Nordlinger's Sections, vol. 8 (Tab. XIV. 4).

SUBGENUS 3. PASANIA.

Ten species. *Q. Lindleyana*, Wall.; Fl. Br. Ind. v. 607; Kurz For. Fl. ii. 480, is a small tree of Upper Burma. *Q. Amherstiana*, Wall.; Fl. Br. Ind. v. 607; Kurz For. Fl. ii. 484, is a large evergreen tree of Tenasserim. *Q. acuminata*, Roxb. Fl. Ind. iii. 636; Fl. Br. Ind. v. 607; Kurz For. Fl. ii. 484; Vern. *Kantagola batana*, Beng., is a large tree of the Chittagong Hill Tracts. *Q. Falconeri*, Kurz; Fl. Br. Ind. v. 608; Kurz For. Fl. ii. 485, is an evergreen tree of Tenasserim. *Q. polystachya*, Wall.; Fl. Br. Ind. v. 610; Kurz For. Fl. ii. 485, is a tree of Manipur, the Shan Hills and Upper Burma.

12. **Q. lappacea,** Roxb. Fl. Ind. iii. 637; Fl. Br. Ind. v. 607; Brandis For. Fl. 489; Kurz For. Fl. ii. 484. Vern. *Oolu chakma*, Beng.; *Thitcha*, Burm.

An evergreen tree. *Pores* large, uniform, isolated, arranged in oblique, more or less radial, branching groups. *Medullary rays* very fine, very numerous, uniform, equidistant, with innumerable, fine, transverse bars across the rays, and no broad rays.

Khasia Hills, Eastern Bengal and Tenasserim.

The acorns have a cup composed of imbricate, soft tomentose scales.

		lbs.
B 553.	Upper Tenasserim	56
B 2715.	Tavoy (Wallich, 1828)	45

This latter specimen is not named, but probably belongs to this species. Nordlinger's Sections, vol. 10 (Tab. XIV. 5).

13. **Q. pachyphylla,** Kurz; Fl. Br. Ind. v. 608; Gamble Darj. List 80. Vern. *Bara katús*, Nep.; *Hlosiri, kashok*, Lepcha.

A large evergreen tree. *Bark* grey-brown, rough. *Wood* grey, durable, moderately hard, showing alternate bands of dark close and light-coloured open tissue, the latter about half the width of the former. *Annual rings* faintly marked by concentric lines. *Pores* scanty, moderate-sized, isolated or in short irregular radial and oblique branching lines, prominent on a vertical section. *Medullary rays* very fine, numerous, uniform and equidistant, no broad rays; silver-grain and tangential grain inconspicuous.

Inner Sikkim Himalaya at 6–10,000 ft.; Manipur at 7–9000 ft.

In the Darjeeling Hills this tree is really the most important of the oaks after *Q. lamellosa*, but it is not so common near the station as is *Q. lineata*. It is a very large tree, reaching a height of 80 to 120 ft. and a girth of 12 to 15 ft. In Manipur, however, Dr. Watt found it growing only as a bush. It is usually found at higher elevations than the Búk, and is especially frequent in the forests of the Singalila range, as about Tonglo. The leaves are greyish and smooth, and the large acorns are remarkable by being crowded together in compact masses containing 3 to 6 nuts. The reproduction naturally is not very good, and artificially it is difficult, so many of the acorns being found to be infertile.

The timber is good, more like chestnut than like that of the Búk and Phalat; it is used for planking, palings, shingles and other purposes, and weighs about 50 lbs. per cubic foot.

		lbs.
E 364.	Rangbúl Forest, Darjeeling, 7500 ft. (Johnston) . . .	51
E 2454.	„ „ „ „ (Gamble) . . .	48
E 2455.	Rangirúm Forest „ „ „ . . .	51
E 3607.	Darjeeling Hills, 8000 ft. (Gamble)	—

14. **Q. fenestrata,** Roxb. Fl. Ind. iii. 633; Fl. Br. Ind. v. 608; Brandis For. Fl. 489; Kurz For. Fl. ii. 483; Gamble Darj. List 81. Vern. *Kala chakma*, Beng.; *Patlé katús*, Nep.; *Kashiendúng*, Lepcha; *Dingjing*, Khasia; *Thitcha, thitèpinzauk*, Burm.

A moderate-sized evergreen tree. *Bark* ½ in. thick, rough, greyish-brown, deeply fissured into small rectangular plates. *Wood* very

hard: sapwood pale; heartwood red. *Pores* large, arranged in groups, and short or oblique belts. *Medullary rays* very numerous, very fine, uniform and equidistant.

Eastern Himalaya, chiefly in Sikkim and Bhutan, where it is common, at 5–8000 ft.; Khasia Hills at 4–5000 ft.; Eastern Bengal and the hills of Martaban and Tenasserim.

In the Darjeeling District, this oak is most common about Tukdah and Dumsong, and its large clusters of acorns are often very conspicuous on the ground under the trees, as the whole spike falls off in one piece. In the Khasia Hills the wood is used for building and farm purposes. Wallich gives W = 47 lbs.

		lbs.
E 3338.	Shillong, Khasia Hills, 5000 ft. (Mann)	—
B 552.	Martaban Hills (Seaton)	56

Sir J. D. Hooker's specimen from Darjeeling in the Kew Museum differs, having very broad medullary rays. It much resembles *Q. lamellosa.*

15. Q. dealbata, Hook. f. and Th.; Fl. Br. Ind. v. 609. *Q. acuminata,* Gamble Darj. List 80, *non* Roxb. Vern. *Sanu arkaula,* Nep.

An evergreen tree. *Bark* thin, grey to greyish-black, smooth. *Wood* light red, very hard. *Pores* scanty, moderate-sized, arranged in short irregular branching lines, which rarely go beyond the spring wood. *Annual rings* marked by the larger pores in the spring wood. *Medullary rays* of two classes: very few broad ones, and numerous, uniform and equidistant very fine ones between them.

Eastern Himalaya at 3–7000 ft.; Khasia and Naga Hills.

I am not sure about the identification of this, as I have lost the herbarium specimens belonging to the wood specimens examined, but it is mentioned in Ed. 1, p. 386, as *Q. acuminata,* which is only a Chittagong species, and I believe that the plant is *Q. dealbata.* The presence of broad medullary rays distinguishes the wood from that of *Q. fenestrata,* which it might otherwise possibly be. The note under that species in Darj. List 80 refers to *Q. acuminata,* and not to *Q. fenestrata.* The tree coppices well, and its wood is a good fuel.

		lbs.
E 2456.	Tukdah Forest, Darjeeling, 5500 ft. (Gamble)	43
E 3333.	Birch Hill Park, Darjeeling, 6500 ft. ,, ...	55
E 3384.	Darjeeling, 6500 ft. (Gamble)	—

16. Q. spicata, Smith; Fl. Br. Ind. v. 609; Brandis For. Fl. 489; Kurz For. Fl. ii. 486; Gamble Darj. List 81. *Q. squamata,* Roxb. Fl. Ind. iii. 638. Vern. *Danwa singali, phaco singali, arkaula,* Nep.; *Bara chakma,* Beng.; *Kacheeng,* Lepcha; *Sahu hingori,* Ass.; *Dingjing,* Khasia; *Thitcha, sagat,* Burm.

A large evergreen tree. *Bark* grey, smooth. *Wood* red, very hard, with very numerous, fine, parallel, wavy, transverse lines. *Annual rings* not traceable. *Pores* moderate-sized and large, in groups, patches and radial often branching lines. *Medullary rays* of two classes: broad and very broad ones, with numerous very fine, uniform and equidistant rays between; the silver-grain being very prominent on a radial section.

Eastern Himalaya from Nepal to Assam, rising to 5000 ft.; Khasia Hills, Naga Hills and Eastern Bengal; drier hill forests of Martaban and Tenasserim.

This fine large-leaved species is variable in foliage and size of fruit. It is often gregarious, and forms in the Darjeeling Hills a sort of coppice wood, preferring somewhat dry exposed ridges, and usually associated with *Engelhardtia spicata* and *Schima Wallichii.* It would be a good tree to grow for tea-estate firewood and charcoal supply. The fruit is collected in spikes, and these spikes are common objects on roadsides in the forests where the tree grows. The wood does not warp and is durable; it is used for building in Assam and for charcoal in Darjeeling; it weighs 58 lbs. per cubic foot on an average.

		lbs.
E 595.	Khooloong Forest, Darjeeling Terai (Manson)	56
E 1444, 1445.	Mishmi Hills (Griffith, 1836)	59 and 55
B 545.	Martaban Hills (Seaton)	63

SUBGENUS 4. CYCLOBALANUS.

Two species. *Q. eumorpha*, Kurz; Fl. Br. Ind. v. 612; Kurz For. Fl. ii. 487, is a small stunted evergreen tree of the forests on the top of the Nattoung Hills of Martaban at 6–7000 ft. *Q. Thomsoni*, Miq.; Fl. Br. Ind. v. 615 (*Q. turbinata*, Roxb. Fl. Ind. iii. 636); Vern. *Bansúa batana*, Beng., is a large tree of the Khasia Hills and Sylhet, extending to Burma and ascending to 5000 ft.

SUBGENUS 5. CHLAMYDOBALANUS.

One species only.

17. Q. lanceæfolia, Roxb. Fl. Ind. iii. 634; Fl. Br. Ind. v. 616; Brandis For. Fl. 489; Gamble Darj. List 81. *Castanea lanceæfolia*, Kurz For. Fl. ii. 482. Vern. *Patlé katús*, Nep.; *Siri*, Lepcha; *Shingra, chauko*, Gáro; *Bucklai*, Ass.; *Hingori*, Cachar; *Dingsning*, Khasia.

A small evergreen tree. *Wood* greyish-white, hard, with alternate bands of dark, close and light open tissue, the latter narrow. *Pores* moderately large to large, scanty, arranged in wavy, radial and oblique branching lines. *Medullary rays* of two classes: numerous, very fine, uniform and equidistant rays, and very few broad rays.

Sub-Himalayan tract of Sikkim and Bhutan, rising to 5000 ft.; Assam, Khasia Hills and Chittagong; Upper Burma and Shan Hills.

Weight 42 lbs. per cubic foot (Wallich). The wood is used for building in Assam. The acorns are completely enclosed in thin, broad, ringed cups, which are set sideways on the branch; they have ruminate cotyledons. The acorns are much liked by some birds, and the Lepchas consequently use them as a bait to catch them.

		lbs.
E 1262.	Tezpur, Assam (G. Mann)	42
	Nordlinger's Sections, vol. 10 (Tab. XIV. 6).	

SUBGENUS 6. LITHOCARPUS.

Two species. *Q. xylocarpa*, Kurz; Fl. Br. Ind. v. 618; Kurz For. Fl. ii. 489, is a tree of Assam, the Garo Hills, the Naga Hills and the hills of Arracan, usually at 4–7000 ft. In Assam, according to Prain, it is found as a gregarious tree or mixed with *Q. lamellosa*. *Q. truncata*, King; Fl. Br. Ind. v. 618, is a tree of Assam, the Naga Hills and Manipur, common at 2–6000 ft.

There is another species, known only from the fruit, *Q. Olla*, Kurz; Fl. Br. Ind. v. 619, a tree of Assam.

4. CASTANOPSIS, Spach.

Twelve species, four of which are Himalayan. Five species are found in Assam and Eastern Bengal, and seven species in Burma. They are very difficult to distinguish; however, so far as the wood specimens available are concerned, I have no doubt of the correctness of the identification. There are three divisions of the genus: *first*, A, that in which the species have spiny globose involucres; *secondly*, B, that in which the involucres are subglobose, and have transversely tubercled zones; and *thirdly*, C, that in which the involucres are flattened on one side, with conical spines on the other. In division A come ten of the species, including those described. *C. diversifolia*, King; Fl. Br. Ind. v. 620 (*Castanea diversifolia*, Kurz For. Fl. ii. 479); Vern. *Kyanza*, Burm., is an evergreen tree, common in the drier hill forests of the Martaban Hills at 3–5000 ft. *C. javanica*, A. DC; Fl. Br. Ind. v. 620 (*Castanea javanica*, Bl.; Kurz For. Fl. ii. 479); Vern. *Thitè*, Ruby Mines, Burma, is an evergreen tree, common along streams in the tropical forests of Burma, with a brown, heavy, strong wood. *C. argentea*, A. DC; Fl. Br. Ind. v. 621 (*Castanea argentea*, Bl.; Kurz

For. Fl. ii. 479); Vern. *Thitcha*, Burm., is also an evergreen tree of the tropical forests of Pegu and Tenasserim, with a stunted form (var. *Tungurrut*, Kurz), in the hills of Martaban at 6–7000 ft. *C. castanicarpa*, Spach; Fl. Br. Ind. v. 621 (*Castanea Roxburghii*, Lindl.; Kurz For. Fl. ii. 480, *Quercus castanicarpa*, Roxb. Fl. Ind. iii. 640), is a large evergreen tree of the forests of Chittagong, extending to Manipur. *C. argyrophylla*, Kurz; Fl. Br. Ind. v. 622, is a scarce tree of Burma found near Rangoon and in Arracan and Tenasserim. *C. armata*, Spach; Fl. Br. Ind. v. 622 (*Castanea tribuloides*, var. *armata*, Kurz For. Fl. ii. 480, *Quercus armata*, Roxb. Fl. Ind. iii. 640), is a tree of the Sikkim Terai, Bhutan Dúars and adjacent lower hills, the Khasia Hills, Assam, Chittagong and Burma up to 3000 ft. *C. Clarkei*, King; Fl. Br. Ind. v. 623; Vern. *Metlein*, Burm., is a large tree of the Bhutan Himalaya, found at Kalimpúng, 5000 ft., by C. B. Clarke, and in the Shan Hills of Burma by Collett. In division B, *C. sumatrana*, A. DC; Fl. Br. Ind. v. 623 (*Castanea inermis*, Lindl.; Kurz For. Fl. ii. 481), is an evergreen large tree of the moister hill forests of Martaban at 4–5000 ft. In division C, *C. rhamnifolia*, A. DC; Fl. Br. Ind. v. 624 (*Castanea rhamnifolia*, Kurz For. Fl. ii. 481), is an evergreen tree of the tropical forests of the Eastern Pegu Yoma and South Tenasserim.

The species of *Castanopsis* have a uniform structure which resembles that of the oaks with one class of medullary rays. *Wood* grey, moderately hard to hard, does not split or warp, seasons well, is durable, and often shows wavy, concentric lines. *Pores* large, in wavy, radial bands, and lines very prominent on a vertical section. *Medullary rays* of one class, very fine, uniform and equidistant.

1. **C. indica**, A. DC; Fl. Br. Ind. v. 620; Brandis For. Fl. 490; Gamble Darj. List 81. *Castanea indica*, Roxb. Fl. Ind. iii. 643; Kurz For. Fl. ii. 478. *Quercus serrata*, Roxb. *l.c.* 641. Vern. *Banj katús*, Nep.; *Kashiorón*, Lepcha; *Serang*, Ass.; *Charang*, Gáro; *Tailo*, Cachar; *Nikari*, *gol-shingra*, Sylhet; *Thitè*, Ruby Mines, Burma.

A moderate-sized, evergreen tree. *Bark* silvery grey, ¼ in. thick, with regular equidistant longitudinal fissures. *Wood* light greyish-brown, hard. *Pores* rather scanty, small to very large, arranged in wavy, interrupted, branching radial lines. *Medullary rays* extremely fine, uniform, equidistant, very numerous. Numerous, very fine, concentric lines or dark-coloured bars joining the rays.

Eastern Himalaya from Nepal to Assam at 1–4000 ft.; Khasia Hills, Eastern Bengal and Chittagong Hills; Upper Burma.

A pretty tree, resembling in appearance the European Chestnut, but with stouter shorter leaves, which are evergreen. It is especially common in the Darjeeling Hills, on old cultivated lands on dry exposures, and coppices well, so that it could easily be grown, though as a fuel tree it is not so good as the oaks.

Growth apparently fast, about 4 to 6 rings per inch of radius. Weight: Wallich gives 39, specimens examined 44 lbs. per cubic foot. Skinner, No. 40, gives W = 35 lbs., P = 404, but as he gives *Theethkaya* for the Burmese name and this species is not described from Lower Burma, he may refer to some other species. The wood splits well, and is very largely used for shingles in Darjeeling. The tree is often pollarded and the branches burnt for manure. The fruit is eaten; it much resembles the filbert, both in shape and in flavour, but has a thinner shell. It is enclosed in a very prickly cup.

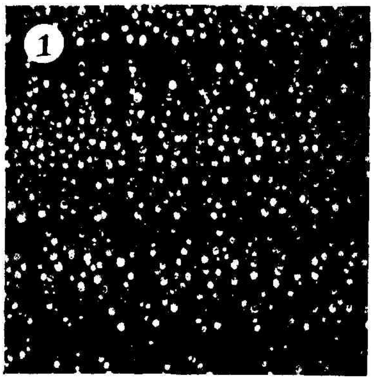
		lbs.
E 494.	Dalka Jhar, Darjeeling Terai (Manson)	43
E 681.	Khookloong Forest, Darjeeling Terai (Manson)	45
E 1254.	Tezpur, Assam (Mann)	44

Nordlinger's Sections, vol. 9 (*Castanea indica*) (Tab. XV. 1).

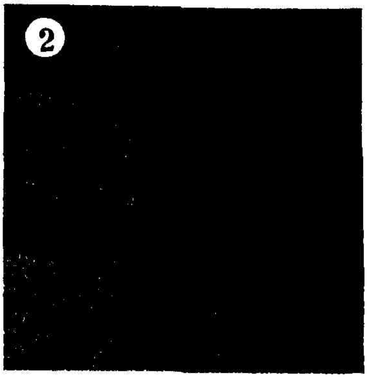
2. **C. Hystrix**, A. DC; Fl. Br. Ind. v. 620; Gamble Darj. List 81. *C. rufescens*, Hook. f. and Th. Vern. *Dalné Katús*, Nep.; *Sirikishu*, Lepcha; *Hingori*, Ass.

A very large evergreen tree. *Wood* grey or light greyish-brown, hard. *Annual rings* marked by narrow belts of firmer texture. *Pores* moderate-sized and large, very scanty, arranged in irregular

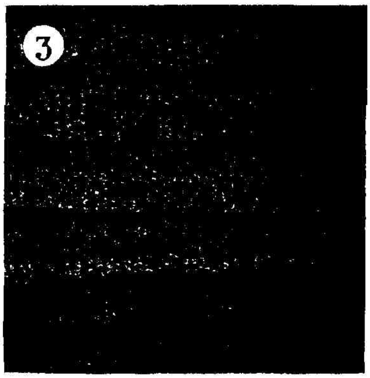
XV.



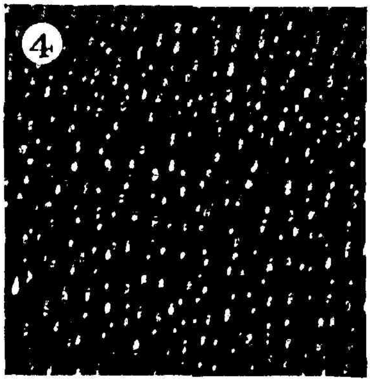
CASTANOPSIS INDICA.



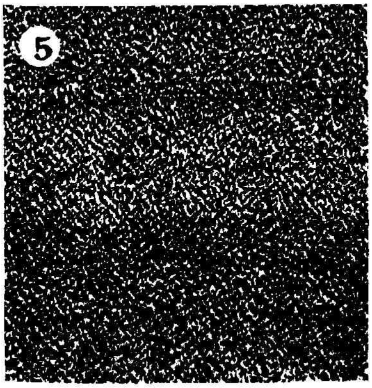
CORYLUS COLURNA.



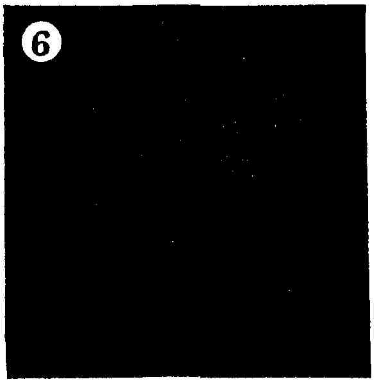
PLATANUS ORIENTALIS.



ENGELHARDTIA SPICATA.



SALIX TETRASPERMA.



POPULUS ALBA.

(Magnified 3½ times.)

short radial and oblique lines. *Medullary rays* very fine, very numerous, uniform and equidistant, with numerous short, fine transverse bars, sometimes forming concentric belts.

Eastern Himalaya, in Sikkim and Bhutan at 6–8000 ft., common round Darjeeling; Assam and the Khasia Hills at 2–4000 ft.

This species is, in the Darjeeling Forests, the chief kind of chestnut, and the tree there grows to a large size, reaching 100 to 120 ft. in height, and 10 to 20 ft. in girth. In Assam and the Khasia Hills it is, however, a much smaller tree.

The growth is moderate, about 8 rings per inch of radius. Weight 46 lbs. per cubic foot. The wood is used in Darjeeling for house-building and other purposes, exactly as that of *Quercus pachyphylla*, which it closely resembles. It gives excellent shingles, and is more valuable as planking and posts whenever exposed to wet than other species of this genus. The fruit is small, but edible and of good flavour; it is enclosed in a large cup with long needle-like spines, longer than those of *C. indica*.

		lbs.
E 354.	Rangbúl Forest, Darjeeling, 7000 ft. (Johnston) . . .	47
E 2457.	" " " " (Gamble) . . .	45

Nordlinger's Sections, vol. 10 (*C. rufescens*).

3. C. tribuloides, A. DC; Fl. Br. Ind. v. 622; Brandis For. Fl. 490; Gamble Darj. List 81. *Castanea tribuloides*, Kurz For. Fl. ii. 480. *Quercus ferox*, Roxb. Fl. Ind. iii. 639. Vern. *Ghiseri, ghogsa, ghogu*, Garhwal; *Túmari, katonj*, Kumaon; *Musré katús, kotur, chisi, maku, shingali*, Nep.; *Kashioshem*, Lepcha; *Bar hingori, hingori, kanta singar*, Ass.; *Dingsaot*, Khasia; *Singhara*, Tipperah; *Kanta lal batana*, Chittagong; *Kyansa*, Burm.

An evergreen tree. *Wood* grey, moderately hard, with alternate dark and light, wavy, concentric lines. *Annual rings* marked by dark lines. *Pores* moderate-sized and large, scanty, in long wavy, often branching radial lines and patches, prominent and characteristic on a vertical section. *Medullary rays* numerous, very fine, uniform and equidistant.

Himalaya, from the Ganges eastwards, ascending to 6000 ft.; Assam, Eastern Bengal and Burma in all the hill ranges.

A common, usually more or less gregarious tree with a very wide range and considerable variability. Peal says that in Assam it runs to 6 ft. in girth, with a clean shaft for about 30 or 40 ft., tolerably straight, after which it forks into large branches. The Darjeeling trees rarely grow so big. He says that the strong spines on the involucre cause great trouble in marching and wound the feet of the travellers; also that the wood is not durable, lasting barely three years, and makes bad charcoal which easily goes into powder. The tree is bad for shading tea, dwarfing the bushes around it. In Darjeeling the wood is used for planking and shingles.

Growth: apparently very fast, 2 to 3 rings per inch of radius, but the rings are doubtful. Weight: Kyd gives weight 43 lbs., P = 483, specimens examined give an average of 37 lbs. per cubic foot. Wallich gives 62, which is much too great unless quite fresh damp wood were weighed. The fruit is eaten; it is similar to that of *C. indica*, but is enclosed in an involucre armed with strong, distant, branching spines. The tree coppices admirably, and with *C. indica*, *Quercus spicata* and *Engelhardtia* should be grown wherever small wood and fuel forests are required, as they often are by planters.

		lbs.
E 626.	Dulka Jhar, Darjeeling Terai (Bonham-Carter) . . .	32
E 495.	Khookloong Forest, Darjeeling Terai (Manson) . . .	39
E 3591.	Tukdah Forest, Darjeeling, 6000 ft. (Gamble) . . .	39

E 4699, sent by H. C. Hill from Dibrugarh, Assam, under the name *Hingori*, has the wood of *Quercus* more than that of *Castanopsis*, as it has distinct broad medullary rays. Weight per cubic foot, 53 lbs.

Tribe III. CORYLEÆ.

5. CORYLUS, Tournef.

Two Indian species. The European Hazel is *C. Avellana*, Linn., found in England, France and eastwards to the Caucasus and Asia Minor.

Wood soft, even-grained, light-coloured. *Annual rings* distinct. *Pores* very small, in radial, often oblique, sometimes branching lines, less numerous in autumn wood. *Medullary rays* of two classes, the broad rays being composed of numerous fine rays. Occasional medullary patches.

1. **C. ferox,** Wall.; Fl. Br. Ind. v. 625; Brandis For. Fl. 494; Gamble Darj. List 82. Vern. *Curri*, Nep.; *Langura*, Bhutia.

A small tree. *Wood* pinkish-white, soft, even-grained. *Pores* scanty, very small, generally in short, radial lines, far apart. *Medullary rays* of two classes: fine and broad, the broad ones numerous. Medullary patches scarce.

Central and Eastern Himalaya at 8–10,000 ft.

Growth slow, 18 rings per inch of radius. The fruit is covered with a very spinous cup, the kernel is edible.

		lbs.
E 376.	Tonglo, Darjeeling, 9000 ft. (Johnston)	38

2. **C. Colurna,** Linn.; Fl. Br. Ind. v. 625; Brandis For. Fl. 494. Vern. *Urni*, Jhelum; *Winri, wiri, warawi, wúriya, thangi, thankoli*, Kashmir and Chamba; *Jangi*, Chenab; *Shurli, sharoli, ban pálu, geh, gey beza, shloi, ban dilla*, Sutlej; *Kapasi, sharori*, Jaunsar; *Kapasi, bhotia badám*, Kumaon.

A moderate-sized tree. *Bark* thin, dark grey. *Wood* pinkish-white, moderately hard. *Annual rings* distinctly marked by a narrow belt of firm wood, with few pores, inside the outer edge of each ring. *Pores* very small, numerous, uniformly distributed, in straight or somewhat oblique radial lines, less numerous in autumn wood. *Medullary rays* fine, numerous, with few broader rays. Medullary patches fairly numerous, more or less concentric.

West Himalaya, from Kashmir to Nepal at 6–10,000 ft. Westward to Europe.

Growth moderate, about 10 rings per inch of radius. Weight about 35 lbs. per cubic foot. The wood is only used locally, but it is well grained and does not warp, and deserves to be better known, especially as many specimens show a fine shining grain resembling Bird's-eye Maple. The fruit is as good as that of the English Hazel, and is largely eaten, if it can be saved from the birds, monkeys and squirrels.

		lbs.
H 57.	Nagkanda, Simla, 80,000 ft.	37
H 908.	Upper Chenab, Punjab (Baden-Powell)	33
H 3179.	Dungagalli, Hazara (Wild)	—

Nordlinger's Sections, vol. 6 (Tab. XV. 2).

6. CARPINUS, Tournef.

Two Indian species. *C. faginea*, Lindl.; Fl. Br. Ind. v. 626; Brandis For. Fl. 492, t. 66; Vern. *Shirásh, ímar, bijauwi*, Pb.; *Gish*, N.-W. P. is a moderate-sized tree of the Himalaya, from the Beas eastward, at 4-7000 ft. The Hornbeam of Europe is *C. Betulus*, Linn., generally found in forests of Oak and Beech throughout the greater part of Europe and eastward to Asterabad, south of the Caspian Sea.

1. **C. viminea,** Wall.; Fl. Br. Ind. v. 626; Brandis For. Fl. 492; Kurz For. Fl. ii. 477. Vern. *Charkhri, lolti, kósh, kái*, Pb.; *Pamné, goria, chamkharak*, N.-W. P.;

Chamleto, kiri, gad kharik, Garhwal; *Shinroi, shangri*, Jaunsar; *Phamnai, phayon, chamria, chamasri, ban kharik*, Kumaon; *Chamria, gadayu*, Dotiál; *Chukissi, konikath*, Nep.; *Pangyauk*, Burm.

A moderate-sized tree. *Bark* grey, compact, ⅛ in. thick. *Wood* white, shining, no heartwood, warps in seasoning. *Pores* small, scanty, often subdivided, in short radial lines. *Medullary rays* of two apparent classes: very numerous very fine rays, with occasional much fewer broad rays.

Himalaya, from the Ravi eastwards, at 5–7000 ft., often near water; Khasia Hills at 5–6000 ft.; Martaban Hills at 5–6000 ft.

Growth moderately slow, Brandis says 10 rings per inch, and specimens examined show the same. The stem is irregular in section like that of the European Hornbeam, which it much resembles in general appearance and in wood except that in the Indian tree the lines of pores are more scanty.

		lbs.
H 3098.	Sipi, Simla, 6500 ft. (Gamble)	50
H 4417.	Jaunsar, 6000 ft. "	46

Order CVI. SALICINEÆ.

The Willows and Poplars belong to this Order, which, with very few exceptions, contains only Himalayan plants within the Indian region. The Order is an important one in the colder countries of the Northern Hemisphere. Two genera: Salix and Populus, between them producing 32 species, some of which are, however, introduced plants, and others merely small shrubs of very cold climates.

Wood soft, even-grained. *Pores* small, numerous. *Medullary rays* fine or very fine, numerous, regular.

1. SALIX, Tournef.

Contains 26 species indigenous in India, as well as 4 species which have been introduced and are fairly common in cultivation, chiefly in the Himalaya. They are divided into three sections: *Pleiandreæ* with several (three or more) free stamens; *Diandreæ* with two free stamens; and *Synandreæ* with two stamens and connate filaments.

The European species of willow, which are very numerous, belong to two sections, the "Sallows," the type of which is *S. Caprea*, and the "Osiers," the type of which is *S. alba*. They are largely cultivated, and are in great use for all purposes, and especially for the protection of river-banks, for basket-work, and for the production of a valuable medicine.

Wood soft, even-grained, white or light red. *Pores* small, numerous, often subdivided, uniform and uniformly distributed, sometimes more or less in a pattern of oblique lines. *Medullary rays* numerous, fine, uniform. *Medullary patches* frequent. The species cannot be distinguished by the structure of their wood alone.

Section I. PLEIANDREÆ.

Three species. *S. ichnostachya*, Ldl.; Fl. Br. Ind. v. 628 (*S. tetrasperma*, Bedd. Fl. Sylv. t. 302, in part), is a tree of South India, recorded in Fl. Br. Ind. as having been found at Pondicherry by Perrottet, and by Wight as occurring in Mysore and in the Shevaroy Hills in Salem. I have specimens collected by Talbot in North Kanara.

1. S. tetrasperma, Roxb. Fl. Ind., iii. 753; Fl. Br. Ind. v. 626; Bedd. Fl. Sylv. t. 302 (in part); Brandis For. Fl. 462, t. 58; Kurz For. Fl. ii. 493; Gamble Darj.

List 82; Talbot Bomb. List 198. Vern. *Bed, bent, baishi*, Hind.; *Laila, bains*, North-Western India; *Bis, beis, bitsa, bin, bidu, bakshel, magsher, safedar, badha*, Pb.; *Yír, bins*, Kashmir; *Bed, jalmála*, Dehra Dún; *Garbains*, Garhwal; *Bhanish*, Kumaon; *Bilsa, bhiúsa*, Oudh; *Pani jama*, Beng.; *Bhesh*, Gáro; *Bhi*, Ass.; *Wallunj, bacha*, Bombay; *Bocha, bitasa*, Mar.; *Nachal*, Kól; *Cheúr*, Kharwar; *Baigay*, Badaga; *Bes*, Monghyr; *Niranji*, Kan.; *Momaka, yethabye*, Burm.

A moderate-sized deciduous tree. *Bark* rough, with deep vertical, rough fissures. *Wood* red, soft, porous, even-grained. *Annual rings* indistinctly marked by lines. *Pores* small, often subdivided, very numerous, uniformly distributed. *Medullary rays* fine, numerous, distinct, bent round the pores.

Throughout India and Burma, on river-banks and in moist places; ascending in Himalayan valleys to 6000 ft. and the hills of South India to 7000 ft.; absent from Ceylon, but found in the Malay Peninsula and Java. In Burma it is found as far north as Myitkyina.

The chief Indian willow, a fine large tree, but exceedingly variable in flower and foliage, so that there are several varieties. Its growth is fast: Minniken found the growth in the Delhi Bela plantation 2 to 2½ rings per inch of radius, while specimens examined give 2 to 7 rings. The wood deserves attention; it has been tried, but not very successfully, for cricket-bats, and it has been used for gunpowder charcoal. Mann says that in Assam it is used for posts and planks. The twigs are made into baskets and the leaves lopped for cattle-fodder. The bark is said by Kurz to be used for tanning, and by Dalzell as a febrifuge. In Brandis' Burma List of 1862, No. 89, the weight is given as 37 lbs. per cubic foot; the average of specimens examined is 31 lbs.

The wood of living trees is frequently found to be badly bored and damaged by the larvæ of a Longicorn beetle, *Batocera* sp.

		lbs.
H 155.	Sainj, Giri Valley	35
H 99.	Bhajji, Sutlej Valley	32
O 1485.	Kheri, Oudh (Wood)	32
O 1465.	Gonda, Oudh "	35
C 2818.	Melghát, Berar (Brandis)	31
E 1256.	Tezpur, Assam (Mann)	35
W 3861.	Ootacamund, Nilgiris, 7000 ft. (Gamble)	—
W 3753.	Coonoor, Nilgiris, 5500 ft. "	31
	Nordlinger's Sections, vol. 10 (Tab. XV. 5).	

2. S. acmophylla, Boiss.; Fl. Br. Ind. v. 628; Brandis For. Fl. 463. Vern. *Bed*, Afgh.; *Bada, bisu*, Pb.; *Jalmala*, Dehra Dún.

A deciduous tree. *Bark* ½ in. thick, rough, dark brown, somewhat corky, deeply and irregularly vertically cleft. *Wood* soft, porous, even-grained; sapwood white. *Annual rings* marked by a line without pores in the autumn wood. *Pores* small, smaller and less numerous than in *S. tetrasperma*. *Medullary rays* fine, numerous, regular.

Himalayan valleys, sub-Himalayan tract and Siwaliks from the Ganges westwards, ascending to 6000 ft.; Afghanistan and Baluchistan.

The specimen described belonged to what is a well-marked variety of the ordinary *S. acmophylla*, approaching to the *S. Safsaf*, Forsk. of Arabia and Egypt. In appearance it is like *S. alba*, but differs in bearing five stamens and in other points. The branches are used for fodder.

		lbs.
H 4807.	Mautargadh Valley, Tehri-Garhwal, 3000 ft. (Gamble)	37

SECTION II. DIANDRÆ.

Nineteen indigenous species and four cultivated ones. *S. sclerophylla*, Anderss., Fl. Br. Ind. v. 630, is a branching shrub of the inner Western Himalaya at

10–15,000 ft. *S. insignis*, Anderss.; Fl. Br. Ind. v. 631; Brandis For. Fl. 470; Vern. *Bitsu*, Pb.; *Gir*, Kashmir, is a large shrub of Kashmir and eastwards to Kunawar at 5–12,000 ft. *S. eriostachya*, Wall.; Fl. Br. Ind. v. 633, is a large shrub or small tree of Nepal. *S. obscura*, Anderss., *S. sikkimensis*, Anderss., *S. Daltoniana*, Anderss. and *S. longiflora*, Anderss., are shrubs or small trees of the inner Sikkim Himalaya above 9000 ft. *S. eriophylla*, Anderss.; Fl. Br. Ind. v. 633, is a spreading shrub of the Khasia Hills at 4–5000 ft. The remaining six species are small prostrate dwarf shrubs of very high regions.

3. **S. Wallichiana**, Anderss.; Fl. Br. Ind. v. 628; Brandis For. Fl. 468, t. 61. Vern. *Bwir*, Pb.; *Bháins*, *bhangli*, *katgúli*, N.-W. P.; *Bhainshra*, Jaunsar.

A large deciduous shrub or small tree. *Bark* greenish-grey, rather smooth, with scattered rounded lenticels, peeling off in large thin flakes. *Wood* light pinkish-brown, soft, even-grained. *Annual rings* marked by a line and the smaller pores of the autumn wood. *Pores* small, numerous, evenly distributed. *Medullary rays* fine, numerous, regular.

Himalaya eastwards to Bhutan, ascending to 9000 ft. and descending, but only occasionally, to the plains; Afghanistan Hills.

A common Himalayan species. Gleadow has sent me from Jaunsar specimens in which the woody tissue projects regularly into the inner bark, giving a fluted appearance to a transverse section, the projections not noticeable on the bark outside. The growth is fast. The branches are used in basket-making and the twigs for tooth-brushes.

		lbs.
H 2910, 3035.	Nagkanda, Simla, 8000 ft. (Gamble)	32
H 4926.	Jaunsar Hills, 7000 ft. (Gleadow)	—

4. **S. Caprea**, Linn.; Fl. Br. Ind. v. 629; Brandis For. Fl. 467, t. 60. The Sallow. *Saule marceau*, Fr.; *Sahlweide*, Germ.; *Salicone*, Ital. Vern. *Bed mushk*, Pb.

A large deciduous shrub or small tree. *Bark* dark grey or yellowish-brown, with irregular longitudinal clefts and short cross-clefts. *Wood* light red, soft, even-grained. *Annual rings* marked by a line and fewer pores in autumn wood. *Pores* small, regular, numerous. *Medullary rays* fine, regular, numerous. *Medullary patches* frequent, elongated concentrically.

Cultivated in the Punjab and Rohilkhand: indigenous in Europe and Northern Asia.

The Sallow is not common, and is generally propagated from cuttings. It is grown in willow-gardens on the bank of the Ravi near Lahore. Mathieu gives the weight of the wood at 27 to 45 lbs., and Nordlinger at 27 to 39 lbs. per cubic foot. Experiments made in 1878 by Captain Call, R.E., at Kandahar, gave, if the determination of the species is correct, with bars 1′ × 1″ × 1″, W = 32·2 lbs. and P = 641 ("Ind. Forester," v. 480).

Nordlinger's Sections, vol. 1.

5. **S. alba**, Linn.; Fl. Br. Ind. v. 629; Brandis For. Fl. 466. The White Willow. *Saule blanc*, Fr.; *Weisse weide*, Germ.; *Salicastro*, Ital.

A large deciduous tree. *Bark* light brown. *Wood* white, pink or light brown, soft, even-grained. *Annual rings* marked by a line and smaller and fewer pores in the autumn wood. *Pores* small, regular, very numerous. *Medullary rays* fine, numerous, regular. *Medullary patches* scarce.

Cultivated in the West Himalaya up to 6000 ft.; indigenous in Europe and Northern Asia.

The white willow often grows to a large size; Brandis mentions 70 to 80 ft. Mathieu gives the weight as 24 to 38 lbs. per cubic foot. Captain Call's experiments, if the species is correctly determined, gave, for Kandahar wood in bars 1′ × 1″ × 1″, W = 27·7 lbs.,

P = 602. It is the best kind of willow for making cricket-bats, and would be worth cultivation for the purpose.

Nordlinger's Sections, vol. 1.

Hough's "American Woods," vol. ii. No. 46.

6. **S. babylonica,** Linn.; Fl. Br. Ind. v. 629; Roxb. Fl. Ind. iii. 754; Brandis For. Fl. 465, t. 59; Gamble Darj. List 82; Talbot Bomb. List 199. The Weeping Willow. Vern. *Bísa, bada, bed, katíra, majnún*, Pb.; *Musru*, Kunawar; *Giúr*, Kashmir; *Gadhbains, manjan*, Garhwal; *Majhiúns*, Kumaon; *Lawria bains*, Dotiál.

A deciduous tree with pendent branches. *Bark* grey, ¼ to ½ in. thick. *Wood* white, soft, porous, even-grained. *Annual rings* marked by a line and smaller and less numerous autumn wood pores. *Pores* small, numerous, evenly distributed. *Medullary rays* fine, numerous, regular.

Cultivated in Northern India, both in the plains and up to 9000 ft.; indigenous, probably, in Central Asia and Persia.

The Weeping Willow is common in gardens in many places. It is reproduced by cuttings, and has been used to plant for the protection of canal-banks and to reclothe slips in wet places. The branches can be used for baskets. The growth is fast, being usually about 4 to 5 rings per inch of radius.

H 3060. Koti, Simla, 7000 ft. (Gamble).

7. **S. elegans,** Wall.; Fl. Br. Ind. v. 630; Brandis For. Fl. 466; Vern. *Beis, bitsu, bed, bida, beli, yir*, Chenab; *Badá*, Ravi; *Báshal, kalishan*, Sutlej; *Bail, blail, bhanis*, Simla; *Choti bashroi*, Jaunsar; *Kadoi, karwi*, Garhwal; *Kale bainsh*, Kumaon; *Bhainsu*, Dotiál.

A deciduous shrub. *Bark* greenish-grey. *Wood* pink, soft, even-grained. *Annual rings* well marked. *Pores* small, numerous, evenly-distributed. *Medullary rays* fine, regular, numerous.

Himalaya from Nepal westwards to Hazara at 6–11,000 ft.

The commonest of the Himalayan willows, often forming a gregarious growth in forest blanks and patches on the hillsides associated with *Rubus, Rosa* and *Berberis*, and useful as a shelter for seedlings either natural or planted. It is used as fodder for cattle and goats. The wood is only used for fuel. It is often attacked by the larvæ of a beetle, a species of *Melasoma*, of the Family *Chrysomelidæ*, near *Melasoma populi*, Linn., which give a powerful and unpleasant scent. The larvæ are found in early June, and the beetles appear at the end of the month or in July (C. G. Rogers in Mus. Notes, iii. 5, 43; see also Stebbing "Inj. Insects," p. 50). The leaves are also attacked, as are those of *S. daphnoides*, by a brilliant orange-coloured fungus, *Lecythea salicina*, Lev.

		lbs.
H 2842.	Mahasu, Simla, 8000 ft. (Gamble)	33
H 2906.	Nagkanda, Simla, 9000 ft. ,, ...	—

8. **S. fragilis,** Linn.; Fl. Br. Ind. v. 630; Brandis For. Fl. 466. The Crack Willow. *Saule fragile*, Fr. Vern. *Tilchang*, Lahoul.

A deciduous tree. *Bark* grey, deeply fissured. *Wood* white or light red, soft, porous, even-grained. *Annual rings* of a well-marked line caused by absence of or very small pores in the autumn wood. *Pores* small to moderate-sized, numerous, evenly distributed. *Medullary rays* numerous, fine, regular, bent round the pores. *Medullary patches* none.

Cultivated in Lahoul and Ladak at over 9000 ft.

The growth is rather slow, about 11 rings per inch of radius.

		lbs.
H 141.	Lahoul (Rev. Mr. Heyde)	28

Nordlinger's Sections, vol. 2.

9. **S. hastata,** Linn.; Fl. Br. Ind. v. 630; Brandis For. Fl. 467.

A deciduous shrub. *Wood* white, soft, even-grained. *Annual*

rings well-marked. *Pores* small, single or in short radial or oblique lines. *Medullary rays* fine, regular, numerous.

Himalaya, in the inner ranges from Kashmir to Garhwal at 9–15,000 ft.; inner Sikkim Himalaya at 11–12,000 ft.

Nordlinger's Sections, vol. 8.

10. S. daphnoides, Vill.; Fl. Br. Ind. v. 631; Brandis For. Fl. 469, t. 62. Vern. *Bed, bidái, betsu, beli, bushan, bashal, bhail, bhéul, mudanu, shún, tháil,* Pb.; *Yúr,* Kashmir; *Changma, chámma, malchang, kalchang,* West Tibet; *Richang, roangching, changkar,* Lahoul; *Kalishan, bhashli,* Sutlej; *Bashrói, bhanishra,* Jaunsar.

A large deciduous shrub or small tree. *Bark* smooth, greenish-grey. *Wood* light red, soft, even-grained, smooth. *Annual rings* marked by a belt without pores in the autumn wood. *Pores* small, numerous, evenly distributed. *Medullary rays* fine, regular, numerous.

West Himalaya, eastwards to Kumaon, above 3000 ft.; westwards to Europe.

A fairly common species of the white oak and mixed forests, especially at about 7–9000 ft. The growth is rather slow, 10 to 15 rings per inch, but the Lahoul specimen shows only 4 rings.

The wood is used in the arid inner valleys for building, pails, tubs, and tools. The twigs are used for baskets, for twig bridges in Piti, Zanskar and Ladak, and for building (willow wattle and daub) in Ladak. It is much grown in Lahoul, from cuttings 9 to 12 ft. long; the trees are pollarded every third or fourth year, and the branches and leaves used for cattle-fodder and litter (Brandis).

	lbs.
H 2854. Mahasu, Simla, 7000 ft. (Gamble)	—
H 47. Kalashi " "	30
H 66. Nagkanda, Simla, 8000 ft.	34
H 2905, 3034, 3036. Nagkanda, Simla, 9000 ft. (Gamble)	35
H 142. Lahoul, about 9000 ft. (Rev. Mr. Heyde)	34

Nordlinger's Sections, vol. 1.

11. S. viminalis, Linn.; Fl. Br. Ind. v. 631; Brandis For. Fl. 470. Osier Willow. *Osier blanc,* Fr.; *Korbweide,* Germ. Vern. *Bitsu,* Pb.; *Kumanta,* Lahoul.

A deciduous shrub. *Bark* shining, grey, slightly cracked. *Wood* white, soft, even-grained. *Annual rings* marked by a line of very small pores in the autumn wood. *Pores* small, numerous, evenly distributed. *Medullary rays* fine, numerous, regular. *Medullary patches* frequent and conspicuous.

Inner Himalaya from the Jhelum to Sikkim (*S. Smithiana,* Willd.) at 5–9000 ft.; cultivated in Lahoul, Dras and Kunawar: extending west to Europe.

H 143. Lahoul, about 9000 ft. (Rev. Mr. Heyde).
Nordlinger's Sections, vol. 1.

12. S. sikkimensis, Anderss.; Fl. Br. Ind. v. 632.

A deciduous shrub. *Bark* dark, smooth. *Wood* soft, red, even-grained. *Annual rings* marked by smaller pores in autumn wood. *Pores* small and numerous in spring wood, very small and scanty in autumn wood. *Medullary rays* very fine, very numerous, uniform, and equidistant.

Sikkim Himalaya, at 9–14,000 ft.

	lbs.
E 966. Chumbi Valley, E. Tibet, 8000 ft. (Schlich)	31

13. S. Daltoniana, Anderss.; Fl. Br. Ind. v. 632.

A small tree, a shrub at higher altitudes. *Bark* blackish-brown, nearly smooth, peeling off in thin flakes, and showing a red under-surface. *Wood* white, soft, even-grained. *Annual rings* marked by grouping of more numerous pores in the spring wood. *Pores* small,

scattered. *Medullary rays* fine, numerous, giving a silver-grain of very small plates.

Sikkim and Bhutan Himalaya, at 9–14,000 ft.
Sikkim, 9000 ft.—Kew Museum (J. D. Hooker).

SECTION III. SYNANDREÆ.

Four species. *S. pycnostachya*, Anderss.; Fl. Br. Ind. v. 636; Brandis For. Fl. 470; Vern. *Changma*, W. Tibet, is a shrub or small tree found growing in clumps in dry stream-beds at high elevations in the inner Western Himalaya at 12-15,000 ft. *S. oxycarpa*, Anderss.; Fl. Br. Ind. v. 636, is a closely allied species found in Kashmir and Kishtwar at 6-11,000 ft. *S. angustifolia*, Willd.; Fl. Br. Ind. v. 637; Brandis For. Fl. 471, is a low shrub of the valleys of inner Kashmir at 7-12,000 ft.; and *S. divergens*, Anderss., a low much-branched shrub of similar regions.

2. POPULUS, Tournef.

Five or six indigenous and one introduced species. *P. microcarpa*, Hook. f. and Th.; Fl. Br. Ind. v. 639, is a tree of Bhutan, found by Griffith between 7000 and 8000 ft.
The Aspen Poplar of Europe is *P. tremula*, Linn.; Brandis For. Fl. 474.

Wood soft, even-grained, porous: sapwood white; heartwood pink or reddish-brown. *Annual rings* distinct. *Pores* small to moderate-sized, often subdivided, evenly distributed. *Medullary rays* very fine, numerous, regular.

1. P. ciliata, Wall.; Fl. Br. Ind. v. 638; Brandis For. Fl. 475; Gamble Darj. List 82. Vern. *Safeda, bagnu, phalja, phlassu, falis, palúch, phalsh, ban phrastu, dud phras, asán, suáli, rikhan, saki, pábe, chanún, krammal, krambal, pahari pipal*, Pb.: *Chelaun, chelún*, Simla; *Piplás, biáon, sharphara, tilaunju, kapási*, Jaunsar; *Chalni, ban pipal*, Garhwal; *Gad pipal*, Dotiál; *Garpipal*, Kumaon; *Bangikat*, Nep.

A large deciduous tree. *Bark* greenish-grey, smooth when young; brown, with deep vertical fissures when old. *Wood* grey or brownish-grey, soft. *Annual rings* marked by smaller and fewer pores in the autumn wood. *Pores* small, numerous, often subdivided or in short radial lines. *Medullary rays* fine, numerous, regular.

Himalaya, from Kashmir to Bhutan at 4–10,000 ft.

This poplar is a common and conspicuous tree in the West Himalaya, in mixed forests, with the Ban and Moru oaks, the deodar and blue pine. It grows fairly fast, quicker at first, more slowly as it gets old, 8 to 9 rings per inch of radius being about an average. The weight of the wood is about 28 lbs. per cubic foot. The wood is used for cattle-troughs, and the leaves as fodder for goats. The wood would do well, were there a demand, for planking, boxes, matchwood and various other purposes like the poplar woods of Europe, but in the Himalaya it is hardly likely to be much in request where deodar, chir and blue pine and the spruce and silver fir woods are available. The leaves and twigs are often covered with galls, probably caused by a species of *Pemphigus* (*Aphidæ*). The leaves are also subject to the attacks of fungi, noticeable being *Uncinula salicis*, DC, which covers them with a white powder; and *Melampsora ciliata*, Barcl., which makes light yellow patches on them.

There is a Darjeeling species found in woods about Kalimpúng and Dumsong, and apparently included with the West Himalayan one, which extends eastwards to inner and higher Sikkim, in Fl. Br. Ind. It is probably a distinct species. It differs considerably in several respects, and is easily recognized by the leaves being square instead of cordate at the insertion of the petiole. Vern. *Sungribong*, Lepcha.

		lbs.
H 3188.	Dungagalli, Hazara (Wild)	—
H 34.	Matiyana, Simla, 7000 ft.	35
H 2884.	Nagkanda „ 8000 ft. (Gamble)	30
H 770.	Kalatop, Dalhousie, 7000 ft. (Pengelly)	26
H 4796.	Kathian, Jaunsar, 7000 ft. (Gamble)	26
E 970.	Chumbi Valley, Tibet, about 8000 ft. (Schlich)	27

2. **P. balsamifera,** Linn.; Fl. Br. Ind. v. 638; Brandis For. Fl. 476. Vern. *Phalsh, makkal, pakhshu, pakh bút, kramal,* Pb.; *Berfa, changma, yarpa, magkal, máhal,* W. Tibet.

A large deciduous tree. *Bark* grey, thick, rough, with longitudinal fissures. *Wood* light grey, soft to moderately hard. *Annual rings* distinctly marked. *Pores* very small and numerous in the spring wood, extremely small, scanty, and in short radial and oblique lines in the firmer autumn wood. *Medullary rays* very fine, uniform, numerous.

Inner arid Himalaya and Tibet at 8-14,000 ft.; westward to Afghanistan, Northern Asia and North America.

Growth slow, 30 rings per inch of radius. The wood is grown for fuel in the inner arid Himalaya, and the branches are lopped for cattle-fodder. The leaves and branches are full of balsamic juice, which also exudes on a fresh cut between the bark and the wood.

		lbs.
H 136.	Lahoul, about 9000 ft. (Rev. Mr. Heyde)	32
	Nordlinger's Sections, vol. 5.	
	Hough's "American Woods," vol. ii. No. 47.	

3. **P. euphratica,** Olivier; Fl. Br. Ind. v. 638; Brandis For. Fl. 474, t. 63. Vern. *Bahan,* Sind; *Bhán, jangli benti, safedar,* Pb.; *Patki,* Brahui; *Hodung,* Ladak.

A large deciduous tree. *Bark* thick, with irregular vertical furrows. *Wood* moderately hard, compact, even-grained: sapwood white; heartwood red, often nearly black near the centre. *Annual rings* marked by a narrow belt with fewer pores. *Pores* small, very numerous, uniformly distributed, often subdivided. *Medullary rays* very fine, uniform, equidistant.

Sind and the Punjab; also in the Upper Valley of the Indus, and its tributaries in Tibet up to 13,500 ft., but not in intervening regions; Baluchistan, Afghanistan, and westward to the Mediterranean; all Tibet and N. Asia to the Altai.

The Bahan poplar has a very remarkable geographical distribution. It is, after the babúl, the most noticeable of the trees of Sind, "where its seedlings spring up in 'abundance, some time after the annual floods have receded, on the fresh alluvial 'deposits (Katchas) which are formed every year by the action of that river. There 'the poplar forms standard trees over the underwood of tamarisk. It is also wild in 'the Southern Punjab, forming thickets along the lower course of the Sutlej river, 'about Multan and between the Sutlej and Indus. It has not been found wild on 'any of the other Punjab rivers" (Brandis). As above noticed, it reappears in the Upper Indus Valley, this being, possibly, the original home. It reaches 40 to 50 ft. in height and 5 to 8 ft. in girth; in the inner Himalaya it is naturally not so big. Brandis says, "where the tree is subject to inundation the lower part of the trunk often gets 'covered with short horn-like roots, similar to what is seen in willows, and from the 'wood of the trunk, short, hard, spine-like processes are often found projecting into 'the inner part of the bark, as in *Ulmus.*" The same growths are observable in *Salix Wallichiana* (see p. 687).

The reproduction of the Bahan poplar is almost entirely from self-sown seed, brought by water, attempts to grow it artificially from seed or cuttings having been found unsuccessful. The tree coppices readily, and gives out a great crop of suckers from the roots, often at considerable distance from the parent tree.

The growth is rapid: Brandis says 3 to 4 rings per inch of radius. In regard to weight, experiments made at Kandahar by Captain Call, R.E., with bars 1′ × 1″ × 1″ gave the weight 27·2 lbs. and 427 for the value of P ("Indian Forester," v. 480). The wood is largely used in Sind for building, turnery, lacquered boxes, but not for fuel for the river steamers or for locomotives, as its heating powers are not great. On the Euphrates and Tigris it is used for planking and boat-building, and in the Punjab for the lining of walls. The inner bark is made into gun-match in Sind, and the bark given as a vermifuge. The leaves are used for fodder for goats and cattle. In Ladak it is much prized for fuel.

Young poles of about 12 years of age fetch a good price, even as much as Rs.30 to 40 per 100 for house-posts, and coppice shoots also make good posts and rafters.

The tree has some insect enemies. Galls on the twigs are formed by an aphid (*Pemphigus napæus*, Buckton), at an elevation of 9000 ft. in the Yasin Valley (Stebbing, "Inj. Insects," p. 18); and the wood is frequently bored and completely riddled by a Sesiid moth larva, *Trochilium omnatiæforme*, Moore, the Baluchistan poplar-borer, discovered and reported by Mr. Cleghorn as found in the Baluchistan plantations, which it had greatly damaged (Stebbing, *l.c.* p. 95).

		lbs.
P 883.	Múltan (Baden-Powell)	32
P 1384.	Indus bank, Central Sind	37

Nordlinger's Sections, vol. 11.

4. P. alba, Linn.; Fl. Br. Ind. v. 638; Brandis For. Fl. 473. The Abele or White Poplar. *Peuplier blanc*, Fr.; *Silber pappel*, Germ.; *Gattice*, Ital. Vern. *Sperdor*, *spelda*, Afgh.; *Chitta bagun*, *safedar*, *jangli frast*, *fras*, *prist*, *rikkan*, *sannún*, *chanún*, *múl*, Pb.

A large deciduous tree. *Bark* ½ to ⅜ in. thick, light grey or yellowish-grey, smooth when young, rougher when old. *Wood* white, often with a red or yellowish tinge, soft, even-grained. *Annual rings* marked by a line and smaller pores in the autumn wood. *Pores* small, often subdivided, numerous, evenly distributed. *Medullary rays* very fine, numerous, regular.

West Himalaya, in Kashmir and elsewhere at 4–10,000 ft., wild and cultivated; westward to Europe and North Africa and north to Siberia.

The white poplar is not a large tree in the Himalaya, though in Europe it reaches a very large size. It is generally grown from cuttings, and rarely flowers. The wood is used to make Afghan grape-boxes: it weighs, according to Mathieu, 28 to 44 lbs. per cubic foot. The leaves are, as reported by Lace, attacked by an orange-red fungus, *Melampsora œcidioides*, Barcl.

Nordlinger's Sections, vol. 2 (Tab. XV. 6).

Hough's "American Woods," vol. iv. No. 96.

H 138, sent from Lahoul by the Rev. Mr. Heyde, is probably this species. It is fast grown, 4 to 6 rings per inch of radius, and weighs 30 lbs. per cubic foot.

5. P. nigra, Linn.; Fl. Br. Ind. v. 638; Brandis For. Fl. 472. The Black Poplar. *Peuplier noir*, Fr.; *Schwarz pappel*, Germ.; *Pioppo*, Ital. Vern. *Frast*, Kashmir; *Sufeda*, Pb. plains; *Prost*, *farsh*, *makkal*, Chenab; *Kramali*, *biúns*, *do*, Sutlej; *Yarpa*, *yúlatt*, *kabúl*, Ladak.

A large deciduous tree. *Bark* thick, grey or blackish-grey, rough, with numerous characteristic deep vertical fissures. *Wood* soft, even-grained: sapwood white; heartwood reddish-brown. *Annual rings* marked by a line and smaller pores in the autumn wood. *Pores* small, often subdivided, numerous, evenly distributed. *Medullary rays* very fine, numerous, regular.

West Himalaya as far east as Simla and up to 12,500 ft.; cultivated only; westward to Europe.

The variety of the Black Poplar found in the Himalaya is almost always the fastigiate form known as the "Lombardy Poplar;" it is very common and conspicuous in avenues in Kashmir, and some of the trees are 90 to 100 ft. in height and 6 to 7 ft. in girth. From the Kuram Valley, Aitchison and Hemsley have described a var. *afghanica* with slender branches and small leaves. The wood is not much used, but, like that of the Abele, it is made into grape-boxes by the Afghans. It weighs, according to Mathieu, 26 to 35 lbs. per cubic foot. It is chiefly propagated by cuttings and flowers rarely. The leaves are lopped for cattle-fodder.

Nordlinger's Sections, vol. 1.

CLASS II. GYMNOSPERMS.

Orders 107 to 109.

As explained at p. 1, the stems of Gymnosperms are characterized by distinct bark and wood, the general presence of annual rings, the presence of medullary rays, but the absence of pores in the two chief Orders. These are the *Coniferæ* and *Cycadaceæ*; in *Gnetaceæ* pores are found, as in Dicotyledons. *Cycadaceæ* are distinguished by having alternate layers of woody tissue and bast tissue.

ORDER CVII. **GNETACEÆ.**

Two genera, Ephedra and Gnetum, containing trees or shrubs, the latter either erect or climbing, and all having branches jointed at the nodes. The Order is a small one, containing, besides the two genera above mentioned, only one other, a genus of a single species, *Welwitschia mirabilis*, Hook. f., a strange thick-stemmed dwarf plant of the stony desert regions of Western tropical South Africa.

1. EPHEDRA, Linn.

Three species are described in the Fl. Br. Ind. as occurring within the limits of the Indian Flora, and at least one other species is found in Baluchistan, which is not included in Sir Joseph Hooker's work or in Dr. Stapf's revision, translation of which is given at p. 863 of the Fl. Br. Ind., vol. v. The only good specimens of *Ephedra* wood which I have seen are two collected by Lace in Baluchistan, and named by him *E. nebrodensis* and *E. vulgaris*, both collected in Zarghun in 1885. They seem identical in bark and structure, and I propose to describe them here under the former name, which is that given, doubtfully, in his paper in *Journ. Linn. Soc.*, xxviii. 305.

E. vulgaris, Rich.; Fl. Br. Ind. v. 640; Brandis For. Fl. 501; Talbot Bomb. List 199; Vern. *Asmánia, búdshúr, bútshúr, chewa*, Pb.; *Khanda, khanna*, Kunawar; *Tse, tsapatt, trano*, Ladak; *Tút-gantha*, Jaunsar, is a small, much-branched, apparently leafless shrub growing in dry stony places and on rocks in Baluchistan, Afghanistan and the Himalaya at 8–16,000 ft.; with a whitish-yellow wood. It is sometimes used for fuel, is browsed by goats, and the scarlet fruit is occasionally eaten. It extends westward throughout South Europe to the Atlantic. *E. pachyclada*, Boiss.; Fl. Br. Ind. v. 641, is a shrub, often rather tall, sometimes very small when much browsed (Lace in Journ. Linn. Soc. xxviii. 301), found in the West Himalaya, Afghanistan and Baluchistan above 6000 ft. *E. peduncularis*, Boiss.; Fl. Br. Ind. v. 641; Talbot Bomb. List 199 (*E. Alte*, Brandis For. Fl. 501, t. 69); Vern. *Kuchan, mikki kúrkan, bratta, tandala, lastúk, nangarwal*, Pb., is a climbing shrub of the plains of the Punjab, Baluchistan, Sind and Rajputana, ascending in the Salt Range to 3000 ft. It is "somewhat gregarious, forming dense clumps of low brushwood in 'the most arid, sandy or stony places" (Brandis). The fruit is eaten, and bunches of the stem and branches are sometimes used to clean brass dishes. *E. foliata*, Boiss. and Ky., is described as a monœcious shrub of the Kuram Valley by Boissier, but Hooker in Fl. Br. Ind. believes it to be only a variety of *E. peduncularis*.

1. **E. nebrodensis**, Tin.; Boiss. Fl. Orient. v. 713. Vern. *Womah*, Baluch.

A shrub. *Bark* grey-brown, rough, vertically fissured in a network of fibrous lines. *Wood* hard, yellowish-white, heartwood pink, with wavy, pale, concentric bands, containing small inconspicuous *pores*. *Medullary rays* fine to moderately broad, fairly numerous, irregular.

Hills of Afghanistan and Baluchistan, above 6000 ft.; westwards to S. France.

P. 4483, 4484 Zarghun, Quetta, Baluchistan (Lace).

2. GNETUM, Linn.

Five species. *G. Gnemon*, Linn.; Fl. Br. Ind. v. 641; Roxb. Fl. Ind. iii. 518; Kurz For. Fl. ii. 497, is a small evergreen tree or large shrub of the Khasia Hills, Manipur, Eastern Bengal and Burma, whose bark is used for cords, and whose leaves are eaten as spinach. *G. neglectum*, Bl.; Fl. Br. Ind. v. 642; Kurz For. Fl. 496, is an evergreen large climber of Arracan and Tenasserim. *G. funiculare*, Bl.; Fl. Br. Ind. v. 643; Kurz For. Fl. ii. 496; Vern. *Gyutnwè*, Burm., is a large climbing shrub of Assam, Chittagong and Burma. *G. macropodum*, Kurz; Fl. Br. Ind. v. 643, is a lofty climber of the Nicobar Islands.

1. **G. scandens,** Roxb. Fl. Ind. iii. 518; Fl. Br. Ind. v. 643; Brandis For. Fl. 502; Gamble Darj. List 82; Talbot Bomb. List 199. *G. edule*, Bl.; Kurz For. Fl. ii. 495. Vern. *Kúmbal, úmbli*, Bombay; *Nanu-witi*, Sylhet; *Apzu tsulu*, Saora; *Lulludi*, Reddi; *Gyutnwè*, Burm.

A large climbing shrub. *Bark* $\frac{1}{8}$ in. thick, brown, rough. *Wood* dark brown, soft, arranged in concentric rings, separated by narrower rings of bast tissue, from the outer edges of which run rays of the same, star-like, into the woody rings, dividing them into wedges. *Pores* large, numerous. *Medullary rays:* none distinct from the bast rays above mentioned. Cellular tissue very open and prominent.

Sikkim Himalaya and eastwards to Assam, and thence down through Eastern Bengal, Chittagong and Burma in the moist mixed forests, and up to 2000 ft.; hills of the Northern Circars; hills of the Western Ghâts from the Konkan southwards up to 7000 ft.; not in Ceylon.

A very interesting plant. Fruit red, edible.

E 3727. Rangbi, Darjeeling, 4000 ft. (Gamble).
C 3786. Mahendragiri Hill, Ganjam, 4500 ft. (Gamble).
W 3794. Ootacamund, Nilgiris, 7000 ft. (Gamble).

ORDER CVIII. CONIFERÆ.

A very important Order of forest trees, the most important of all in the Northern temperate regions of the world, where the Coniferous forests occupy by far the largest proportion of the forest area, affording the principal and most generally used timbers. In India, with very slight exceptions, the Coniferous trees belong to the Himalaya and the connected ranges of Assam and Burma, there being one species only in Southern India and none in Ceylon.

In India there are twelve genera belonging to five Tribes, a sixth Tribe containing genera which have cultivated representatives. To the twelve genera I add two, *Thuya* and *Cryptomeria*, in which there are trees of very common occurrence and some importance, though not indigenous.

Tribe I.	Cupressineæ	Thuya, Cupressus, Juniperus.
„ II.	Taxodieæ	Cryptomeria, Cephalotaxus.
„ III.	Taxeæ	Taxus, Dacrydium.
„ IV.	Podocarpeæ	Podocarpus.
„ V.	Araucarieæ.	
„ VI.	Abietineæ	Pinus, Cedrus, Picea, Tsuga, Abies, Larix.

The wood of coniferous trees is of very simple structure. It has no vessels, and hence, on a horizontal section, there are no *pores*. The wood consists of two elements: (1) a tissue of cells called *tracheides*, which are long and pointed and dotted with bordered pits chiefly on their radial walls, and which have a more or less rectangular section; and (2) *medullary rays* which are composed of two kinds of cells, namely, parenchymatous cells with simple pits, and tracheides with bordered pits. In many species *resin-ducts* are also found, which may be vertical in the cellular tissue or horizontal in the larger medullary

rays. Resin is in some species found in the cells. The *annual rings* are generally conspicuous, marked by the smaller tracheides of the autumn wood, which is usually harder and heavier than the somewhat porous spring wood, and with smaller cavities (lumina). Consequently a slow-grown wood is harder and stronger than one which has grown quickly. The *medullary rays* are usually somewhat irregularly spaced, having from two to several rows of tracheides between them. They are rarely broad, usually fine to moderately broad.

Coniferous woods may be classified as follows:—

Without resin-ducts.

With well-marked annual rings. *Thuja, Cupressus torulosa, Juniperus, Crytomeria, Dacrydium, Taxus, Cedrus, Picea.*

With obscurely-marked annual rings. *Cupressus sempervirens* and *funebris, Cephalotaxus, Podocarpus.*

With resin-ducts. *Pinus, Tsuga, Abies, Larix,* those in *Tsuga* and *Abies* being sometimes very scanty or absent. *Cupressus funebris* has occasional resin-ducts.

NOTE.—It is curious that in Europe *Picea excelsa*, the Spruce, has resin-ducts, while *Abies pectinata*, the Silver Fir, has none. The converse seems to be the case in India.

TRIBE I. CUPRESSINEÆ.

Besides the genera here described, *Callitris* contains some species which are found in cultivation, the chief of which is *C. rhomboidea*, Br. (*Frenela rhomboidea*, Endl.; Benth. Fl. Aust. vi. 237), a small Australian tree. This, I believe, is the species which is cultivated in the Nilgiris, where it can also reproduce itself from seed. It has been used for hedges, also as a nurse for other trees, and is likely to be a useful fuel plant. The Australian species of *Callitris* are usually called "Cypress Pine." *C. quadrivalvis*, Vent.; Brandis For. Fl. 535, is a large tree of the forests of Algeria, remarkable for the beautiful grain of the wood of the knotty roots. This root-wood is caused by ill-treatment by cutting and burning, and is made into carved articles, some of which are of considerable beauty; also into veneers for cabinet-work.

1. THUYA, Linn.

The Arbor-Vitæ. About 12 species, mostly American or N.-E. Asiatic. The chief and largest species is *T. gigantea*, Nutt., the "Yellow Cypress" of the Pacific coast of America, which grows to a very large size and has a fine timber.

1. T. orientalis, Linn. *Biota orientalis*, Endl.; Brandis For. Fl. 534. The Chinese Arbor-Vitæ.

A small evergreen tree. *Bark* brown, thin, peeling off in flakes. *Wood* moderately hard, close-grained: sapwood white; heartwood reddish-brown. *Annual rings* a well-marked narrow line. *Medullary rays* fine, numerous, very short.

Indigenous in China and Japan. Very frequently planted in India, especially about hill stations.

The trees in the Dhobijhora Plantation in the Darjeeling Hills, planted about 1866, had in 1899 a girth of nearly 3 ft., which is large for the species.

	lbs.
O 4495, 4561. Forest School Garden, Dehra Dún (Gamble)	33
E 3414. Darjeeling, 7000 ft. (Gamble)	—
Nordlinger's Sections, vol. 1.	

2. CUPRESSUS, Linn.

One indigenous species; others cultivated. Perhaps the best general account of the Cypresses is that of Dr. Maxwell T. Masters, F.R.S., in Journ. Linn. Soc. xxxi. 312, where 14 species are admitted. *C. glauca*, Lamk.; Fl. Br. Ind. v. 645; Brandis For. Fl.

534, is the "Goa Cypress." Its native country is uncertain. Dalzell and Gibson in Bomb. Fl. Suppl. p. 83, says that it is cultivated in the Bombay Ghâts, but only succeeds where the soil is rich and deep, and not at all below Ghât. *C. macrocarpa*, Hartw. is a fine species found in California and having the appearance of a cedar. It is much cultivated in the Nilgiris and grows very fast. *C. Lawsoniana*, A. Murray is the beautiful "Lawson's Cypress," also from the Pacific coast of America. It has been occasionally cultivated in the Indian hill stations, as at Darjeeling.

Wood homogeneous, fragrant. *Annual rings* marked by a narrow distinct line, absent in some species. *Medullary rays* very numerous, fine, long. Occasional *resin-ducts* in *C. funebris*, scarce or absent in other species, replaced by having some of the wood-cells, especially near the annual rings, filled with resin. These are prominent in *C. torulosa*, old specimens.

1. **C. torulosa**, Don; Fl. Br. Ind. v. 645; Brandis For. Fl. 533. The Himalayan Cypress. Vern. *Devi-diár*, Ravi; *Deodar*, Kulu, Bhajji; *Gulla, gulrai, kallain*, Simla; *Leauri, leori*, Jaunsar; *Raisalla, sarai*, Kumaon; *Rasúla*, Garhwal; *Dhúpi*, Dotiál; *Sarrú, súrah-vyu, surin*, Tibet.

A large evergreen tree. *Bark* ½ in. thick, brown, the outer layer peeling off in long, narrow, thin fibrous strips, inner substance reddish-brown. *Wood* moderately hard, close-grained: sapwood white; heartwood light brown with darker streaks, very fragrant. *Annual rings* distinctly marked by a narrow, firm and dark-coloured belt. *Medullary rays* very fine and extremely fine, moderately long, very numerous. Cells with resin in lines near the annual rings, in very old trees very numerous.

Outer ranges of the Western Himalaya, from Chamba to Nepal, scattered and in numerous isolated localities of greater or less extent, chiefly on limestone, between 5500 and 9000 ft.

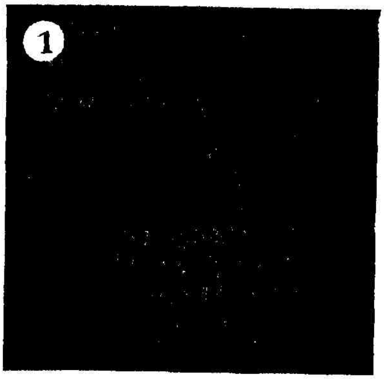
This most beautiful tree is found rather locally in places which suit it. Brandis mentions several localities, such as: small patches on the Ravi, parts of Kulu, limestone rocks of the Shali and Tika Hills near Simla, Lokandi and Moila Hills on limestone in Jaunsar, limestone below Karamba Peak in Jaunsar, Chinar Peak above Naini Tál on clay slate, but near limestone, Garhwal, Kumaon and Nepal. It is also found in the Bamsu Valley in Tehri-Garhwal of considerable size. It reproduces well from seed and very often in the crevices of vertical precipices, as at Moila, where it grows first outward and then straight up close to the rock. The average growth is slow, about 15 rings per inch of radius. It has been a good deal planted and is easy to rear, though a large proportion of the seeds fail to germinate. It grows well and fast (No. O 4644 shows 2 to 3 rings per inch of radius) even in the plains of India, and may be seen in quantity at Dehra Dún, Saharanpur, Chikalda in Berar and even Calcutta. It often reaches a large size, the well-known tree at the Deota temple in the Tons Valley had recently a girth of 22 ft. and a height of 154 ft., and Stewart and Brandis mention others nearly as large, or larger, one even 27 ft. in girth.

The timber is very durable, even more so than deodar, as is shown by the results of buried sleepers of the wood at Dehra Dún (Ind. For. xix. 207). These pieces were put down in 1881 and taken out in 1892, 11 years later, and the Cypress wood was found to have resisted the best of all. It has been found very good for sleepers, but is not procurable in sufficient abundance to be much used. The average weight is about 38 lbs. per cubic foot. It is good for building, equally with deodar, and is frequently employed for temples in the Himalaya, as well as for images and poles to carry the sacred arks. The wood also is burnt as incense. It gives very little ash, Dr. Warth's experiments gave only 0·1 per cent. ash in steam-dry wood, the ash chiefly consisting of carbonate of lime and phosphates of iron and lime.

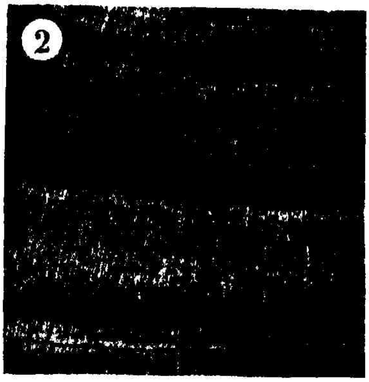
Young plants are often seen affected by a fungus, *Gymnosporangium Cunninghamianum*, Barcl., which occurs as a yellow gelatinous mass. The alternate generation is on leaves of *Pyrus Pashia* ("Ind. For." xxv. 435).

		lbs.
H 30.	Tika, Simla, 8000 ft.	34
H 61.	Kandru, Simla, 8000 ft.	42

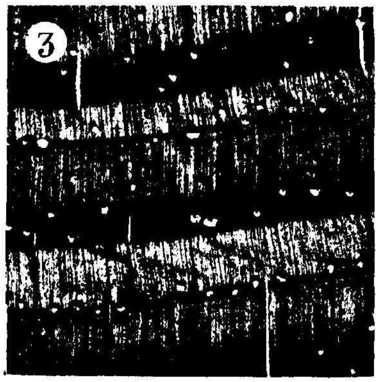
XVI.



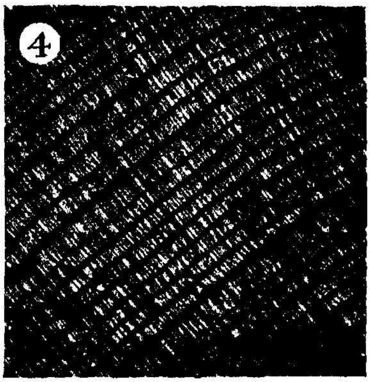
CUPRESSUS TORULOSA.



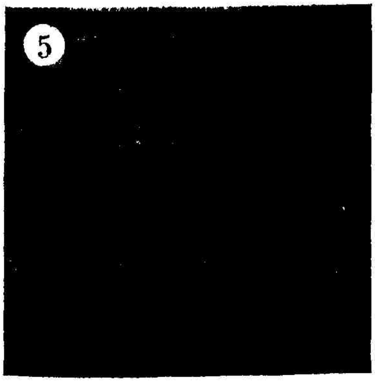
PODOCARPUS NERIIFOLIA.



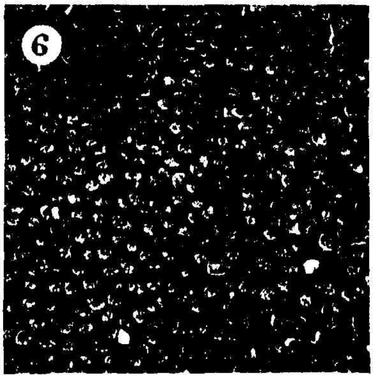
PINUS LONGIFOLIA.



CEDRUS LIBANI, *var.* DEODARA.



ABIES PINDROW.



PHŒNIX DACTYLIFERA.

(Magnified 3½ times.)

		lbs.
H 771.	Belj, near Bassú, Chamba, 7000 ft. (Pengelly)	36
H 613.	Kulu, 7000 ft. (Pengelly)	44
O 4644.	Forest School Garden, Dehra Dún (Gamble)	34

Nordlinger's Sections, vol. 10 (Tab. XVI. 1).

W 4339, from a planted tree in the Botanic Garden, Ootacamund, called *C. cashmiriana*, 31 lbs. per cubic foot, may be this species. The wood is white.

2. **C. sempervirens**, Linn.; Fl. Br. Ind. v. 645; Brandis For. Fl. 533; Roxb. Fl. Ind. iii. 653. The Cypress. *Cyprès*, Fr.; *Cipresso*, Ital. Vern. *Sara*, *Saras*, Hind.

A tall evergreen tree. *Bark* thin, light brown, fibrous, peeling off in thin strips. *Wood* light brown, moderately hard to hard, close- and even-grained. *Annual rings* usually distinctly marked by a firm line, sometimes indistinct in specimens grown in equable climates (*e.g.* spec. from Ceylon). *Medullary rays* fine, brown, very numerous. Resin-cells not common.

Indigenous in Persia, Syria, and Asia Minor; cultivated in Northern India and elsewhere both in the ordinary and fastigiate varieties.

The fastigiate variety is the most common in gardens. In India it reaches sometimes 6 to 7 and even 9 ft. in girth and a height of 70 to 100 ft. (Brandis).

		lbs.
O 3267.	Saharanpur Bot. Garden (Duthie)	37
4940.	Ceylon (Alexander).	30

Nordlinger's Sections, vol. 4.

3. **C. funebris**, Endl.; Fl. Br. Ind. v. 646; Brandis For. Fl. 534; Gamble Darj. List 82. The "Funereal Cypress" or "Weeping Cypress." Vern. *Chandang*, *tchenden*, Bhutia; *Tsandan*, Lepcha.

An evergreen tree with pendulous branches. *Bark* brown, fibrous. *Wood* moderately hard, close- and even-grained, light yellow, with watermark-like concentric bands of darker or lighter tissue, caused by a change in size of wood-cells. *Annual rings* none, or only found in young trees. *Medullary rays* very fine, very numerous and close. Resin-cells none or very few. *Resin-ducts* occasional.

Indigenous in China. Cultivated in the Eastern Himalaya, in Nepal, Sikkim and Bhutan at 4–8000 ft., chiefly near temples and monasteries.

A fine species, not difficult to grow. It is one of the trees planted at the Dhobijhora Plantation near Kurseong (where trees planted in 1866 had in 1899 a girth of over 4 ft.), and there are several specimens about Darjeeling. A fine one may be seen at the Tasingthong monastery in British Bhutan.

		lbs.
E 972.	Darjeeling Hills, about 5500 ft. (Schlich)	34

Nordlinger's Sections, vol. 10.

3. JUNIPERUS, Linn.

A large genus of about 25 species, four of which are found in India, in the Himalaya and the mountains down to Baluchistan. One of these is *J. communis*, Linn., which extends to Europe. Among non-Indian Junipers, the most important are *J. virginiana*, Linn., of the Atlantic coast of North America, and *J. bermudiana*, Linn., of the Bermudas, West Indies and Florida, which are the trees whose woods are the most used for making pencils (Pencil Cedar or Red Cedar).

Wood homogeneous, fragrant, close- and even-grained, soft to moderately hard: sapwood white; heartwood red. *Annual rings* well marked by a prominent, distinct line. *Medullary rays* very fine to fine, extremely numerous and regular. No *resin-ducts*, but resin-cells in concentric lines in some species.

1. **J. communis**, Linn.; Fl. Br. Ind. v. 646; Brandis For. Fl. 535. The Juniper. *Genévrier*, Fr.; *Wachholder*, Germ.; *Ginepro*, Ital. Vern. *Núch*, *páma*, *pethra*,

bentha, betar, Kashmir, Chamba and Kulu; *Lang shúr, pama, thelu, lewar*, Kunawar; *Chúni, shúpa*, Piti; *Sbama*, Lahoul; *Chichia*, Kumaon; *Chache, pates*, Byáns.

A large evergreen shrub. *Bark* thin, reddish-brown, fibrous. *Wood* white; heartwood yellowish or pale red, fragrant, moderately hard. *Annual rings* marked by a distinct line. *Medullary rays* very fine to fine, close, numerous and regular.

West Himalaya, eastwards to Kumaon, at 5500–14,000 ft.; westwards through Western Asia and Europe.

In the Himalaya the common Juniper rarely attains more than 6 to 7 ft. in height, often with a disproportionately thick stem, 18 to 24 in. in girth. Growth extremely slow, the specimens show: one 35, the other 50 rings per inch of radius. Weight, according to Mathieu, Fl. For. p. 515, 34 lbs.; the specimen gives 33 lbs. per cubic foot. The wood is used for fuel, and, as well as the leaves and twigs, is burnt as incense (*dhúp*). The fruit is sweet, aromatic and resinous; it is sold in the bazars of North India as a medicine (*abhúl, húber*), and is administered in decoctions as a stimulant and diuretic. In Europe the berries are used to flavour gin.

		lbs.
H 137.	Lahoul, about 10,000 ft. (Rev. Mr. Heyde)	33
H 907.	Upper Chenab „ (Baden-Powell)	—
	Nordlinger's Sections, vol. 1.	

2. **J. pseudo-sabina**, Fisch. and Mey.; Fl. Br. Ind. v. 646. *J. Wallichiana*, Hook. f. and Th.; Brandis For. Fl. 537. The Black Juniper. Vern. *Bhil*, Hind.; *Poh*, Tibet; *Shirchin*, Byáns; *Tchokpo*, Bhutia.

An evergreen shrub or tree. *Bark* brown, smooth, exfoliating in large flakes. *Wood* that of the genus.

Himalaya, from the Indus to Bhutan, at 9–15,000 ft.

This species is merely a bush in the West Himalaya, but a tree, sometimes 60 ft. high, in Sikkim (see picture in Hook. Him. Journ. ii. 55).

H 129. Rotang Pass, Lahoul, 12,000 ft. (Rev. Mr. Heyde).

3. **J. recurva**, Ham.; Fl. Br. Ind. v. 647; Brandis For. Fl. 536; Gamble Darj. List 82. The Weeping Blue Juniper. Vern. *Wetyar, bettar, chúch, thelu, telu, talu, phulu*, Pb.; *Bettir, bhedára, bendhara, bidelganj, thelu, phulu, jhora, gúggal, bil, úrú, agáni*, N.-W. P.; *Tupi, aru, uguru*, Nep.; *Páma*, Tibet; *Deschú*, Sikkim; *Chakbu, resúk, desu, sukpo*, Lepcha.

An evergreen tree or straggling shrub. *Bark* brown, thin, peeling off in long fibrous strips. *Wood* moderately hard, very fragrant: sapwood white; heartwood light red. *Annual rings* marked by a prominent line. *Medullary rays* numerous, fine and very fine, rather short.

Inner Himalaya at 7500–15,000 ft., extending westwards to Afghanistan, eastwards to Bhutan.

In Sikkim and Bhutan, this is a rather large graceful tree, and good specimens may be found on Sandukpho in the Darjeeling District, though it is still more common in Sikkim, and grows to 30 ft. high (picture in Hook. Him. Journ. ii. 28). In the North-West it is a prostrate or straggling bush (var. *squamata*, Parlat.), which I have found on the northern slopes of Chansil in Bashahr at 12,000 ft. The growth is slow, about 22 rings per inch for Sikkim wood and nearly twice as many for North-West wood. The wood is very good, quite equal to the best pencil-cedar; but it is not used, except to burn as incense in the Buddhist temples. The foliage is of a glaucous blue colour.

		lbs.
H 144.	Lahoul (Rev. Mr. Heyde)	47
H 4573.	Chamdhár Thach, Chansil, Bashahr, 12,000 ft. (Gamble)	35
E 374.	Sandukpho, Darjeeling, 12,000 ft. (Johnston) . . .	38
E 2438.	„ „ „ (Gamble)	42

4. **J. macropoda**, Boiss.; Fl. Br. Ind. v. 647. *J. excelsa*, Brandis For. Fl. 538, t. 68. The Himalayan Pencil Cedar. Vern. *Appurz*, Baluchistan; *Obúsht*, Pathan; *Chalai*, Jhelum; *Shúkpa, shúr, shúrgu, lewar*, Chenab and Sutlej; *Liúr*, Ravi; *Shúr-*

búta, shúrgú, shúkpa, Tibet; *Dhup, padám, padmak, súrgi*, N.-W. P.; *Dhúpi, dhúpri chandan, shúkpa*, Nepal.

A moderate-sized evergreen tree. *Bark* thin, reddish-brown, fibrous, peeling off in thin longitudinal flakes. *Wood* moderately hard, fragrant: sapwood yellowish; heartwood red, often with a purplish tinge. *Annual rings* distinct, in a well-marked line. *Medullary rays* obscure, extremely fine and fine, the latter short.

Inner dry ranges of the Himalaya, extending east to Nepal and westwards to Afghanistan, at 5–14,000 ft.; Baluchistan.

This is the chief Indian juniper, but its *forest* importance is greatest in Beluchistan. Aitchison says it forms fully half of the forests at 9000 ft. in the Hariáb District. It forms pure forests at Ziarat, and in the Pil and Zarghun ranges. Lace says of it, in Journ. Linn. Soc. xxviii. 307: "The best forests are situated some 60 miles east of 'Quetta, in the neighbourhood of Ziarat and extending over more than 200 square 'miles of country. It usually exists in open forest. Trees with clean boles are very 'rare, and they are generally branched from the base; the lowest branches being often 'buried in leaf detritus near the trunk, and their extreme ends taking an upward 'turn, give them the appearance of young trees surrounding the old one. The growth 'of the juniper is very slow, yet it attains 20 ft. in girth and occasionally 70 ft. in 'height. Although it reproduces itself from seed, very few of the seedlings survive. 'The wood is light, has little strength, and burns quickly; it is employed extensively 'in building, principally for rafters, but even more for fuel. The bark is of immense 'thickness at the base of old trees, and is taken off in long pliant strips by the 'Pathans, who use it for roofing their huts. A kind of liquid called 'Doshah' is 'prepared from the fruit, and the fruit is also employed in curing skins." Its chief companions are *Pistacia mutica*, var. *cabulica*, *Fraxinus xanthoxyloides* and *Prunus eburnea*. The following account of the reproduction by A. M. Reuther, given in his Forest Report of Baluchistan for 1894–95, is interesting:—

"Extended examination of the forests has shown that a fairly plentiful advance 'growth of juniper exists in most places where gaps in the cover have occurred through 'felling or burning of single trees or small groups. This is especially noticeable in the 'immediate vicinity of the very numerous dead juniper trees, killed by fire, which are 'so conspicuous a feature on every hillside within the old-established forest pasture-'grounds, and which afford clear evidence of the widespread injury to the forest growth 'caused by the practice (now happily almost extinct) of setting fire to standing trees 'for the purpose of protecting flocks at night against beasts of prey. These dead trees 'are almost everywhere surrounded by young junipers of sizes varying from a few 'inches to several feet in height, growing vigorously without much shelter. The prin-'cipal agent in dissemination of the seed in such situations appears to be a bird named 'by the Pathans 'Obisht-khwarak' (juniper-eater), which feeds largely on the seed 'of the juniper when ripe. The condition of the juniper forest leaves no room for 'doubt that with proper protection their reproduction, though extremely slow, is quite 'safe and certain, and the fears entertained in this respect in the early years of forest 'conservancy in Baluchistan were groundless."

Of the tree in its Himalayan habitat, Brandis gives much information. He says it is generally gregarious on rocky slopes; that it does not generally reach a height greater than 50 ft., but that the girth is often considerable, 6 to 7 ft. being not uncommon, while exceptionally 20 ft. or more are reached. One tree in Lahoul had 33½ ft. The rate of growth is very slow indeed. The wood is used in Lahoul for the wall-plates and beams of houses, alternating with stone; in Kunawar, temples are built of it, and it is made into drinking-cups and walking-sticks, and burnt as incense. At Leh it is (chiefly the driftwood of the Zanskar river) used for fuel, and it is sometimes made into charcoal. Aitchison says that in the Kuram Valley strips of the bark are used as pads for carrying water-jars. It can be easily planted, and has been grown even in the plains of India at Saharanpur.

			lbs.
H	163.	Hazara, 7000 ft.	32
H	772.	Barmúr, Ravi, 7000 ft. (W. Pengelly)	34
H	906.	Upper Chenab Valley, 8000 ft. (Baden-Powell)	—
H	139.	Lahoul, about 8000 ft. (Rev. Mr. Heyde)	34
H	608.	" " " (W. Pengelly)	29
P	4482.	Baluchistan (Lace)	40

TRIBE II. TAXODIEÆ.

Besides the genera described, this Tribe contains the important genus *Sequoia*, in which come the two giant trees of California. *S. sempervirens*, Endl. is the "Redwood," which sometimes reaches a height of 300 ft. and a girth of 66 ft.; and *S. gigantea*, Torrey is the "Wellingtonia" or "Mammoth tree," which attains 350 ft. in height and 110 ft. in girth. The timber of the former is good, but that of the latter is rather poor. They are both much planted in Europe, but are not yet in cultivation in India, except perhaps as isolated specimens in hill Botanic Gardens. *Taxodium distichum*, Rich. is the "Swamp Cypress" of the Southern United States of America, a deciduous-leaved tree often planted in Europe.

4. CRYPTOMERIA, Don.

1. C. japonica, Don; Gamble Darj. List 83.

A very large evergreen tree. *Bark* brown, fibrous, peeling off in narrow strips. *Wood* soft, fragrant: sapwood white; heartwood reddish-brown, often almost black in old Japanese trees. *Annual rings* marked by broad, very prominent lines. *Medullary rays*, several very fine, and then a broader fine ray, very numerous, regular.

Indigenous in Japan: cultivated in India, especially in the Darjeeling District, at 4–7000 ft.

The seeds of the Cryptomeria were first brought to India by Mr. Fortune in 1844. The trees about the station of Darjeeling are probably the oldest, but at that elevation, 7000 ft., they do not grow so quickly or thrive so well as lower down at 4–6000 ft. The first attempt to grow them in plantation was probably that made about 1866 at Dhobijhora near Kurseong, where in 1899 the trees had a girth of 43 in. They are now largely grown, and especially through the energy of Sir G. King and Mr. J. A. Gammie, at the Government Cinchona Plantations of Sureil, where they thrive admirably. The growth is very fast, and seeds are produced in abundance. The wood makes excellent tea-boxes, and is good as a substitute for deal.

	lbs.
E 697. Rungbee, Darjeeling, 5500 ft. (King)	21
E 3615, 3679. Rangirúm, Darjeeling (Gamble)	—
Nordlinger's Sections, vol. 10.	

5. CEPHALOTAXUS, Sieb. and Zucc.

1. C. Mannii, Hook. f.; Fl. Br. Ind. v. 647.

A small tree. *Bark* light brown, thin, peeling off in small flakes. *Wood* very light brown, soft, even-grained. *Annual rings* faintly marked by a dark band. *Medullary rays* fine, long, numerous.

Khasia Hills at 5000 ft.; hills of Upper Burma.

	lbs.
B 4431. Upper Burma (J. W. Oliver)	36

2. C. Griffithii, Hook. f.; Fl. Br. Ind. v. 648. Vern. *Tinyu*, Burm.

A small tree. *Bark* dark brown, very thin, peeling off in large papery flakes. *Wood* very light brown, moderately hard, even-grained. *Annual rings* marked by a dark autumn line. *Medullary rays* very fine, numerous.

Mishmi Hills at 6000 ft.; Manipur; hills of Upper Burma.

B 4430. Bernardmyo, Upper Burma, 5500 ft. (J. W. Oliver).

TRIBE III. TAXEÆ.

Ginkgo biloba, L. (*Salisburia adiantifolia*, Sm.), the "Maidenhair tree" of China and Japan, is a large deciduous tree of graceful foliage sometimes seen in cultivation in

Indian gardens. The *wood* is yellowish-white, moderately hard, with faintly marked *annual rings* and many rather indistinct fine *medullary rays*.

(O 4499. Saharanpur Bot. Garden and Nordlinger's Sections, vol. 1.)

6. TAXUS, Tournef.

1. **T. baccata,** Linn.; Fl. Br. Ind. v. 648; Brandis For. Fl. 539; Gamble Darj. List 82. The Yew. *If*, Fr.; *Eibe*, Germ.; *Tasso*, Ital. Vern. *Saráp, badar*, Afg.; *Birmi, barmi, barma, barini, túng, thúnu, sungal, püstül, chogu, chatúng*, Kashmir, Chamba; *Choga*, Pangi; *Rakhal*, Beas; *Barmi*, Shali; *Thúna*, Hattu; *Yamdal, rikaling, ekaling, arkhan, kaderu*, Kunawar; *Thúner, geli, gallu, lúst*, N.-W. P.; *Nhare*, Tibet; *Pung-cha, sungcha*, Ladak; *Thúner, thaunára*, Jaunsar; *Tcheiray sulah*, Nep.; *Tingschi, tsa*, Bhutia; *Cheongbu, tunsi*, Lepcha; *Dingsableh*, Khasia; *Tinyu*, Burm.

A large evergreen tree. *Bark* thin, purplish-grey, peeling off in longitudinal flakes. *Wood* hard, close- and even-grained, smooth: sapwood white; heartwood orange-red, light red or white. *Annual rings* marked by a conspicuous line. *Medullary rays* fine and extremely fine, very numerous, regular and long.

Himalaya at 6–11,000 ft., extending westwards to Afghanistan and eastwards to Bhutan; Gáro and Khasia Hills at 5000 ft.; Upper Burma, in the Ruby Mines Hills at 5–6000 ft. Extends to most temperate regions of the Northern Hemisphere.

The Yew is a conspicuous tree in the Himalayan forests, usually in shady places under other trees. In the West Himalaya it is most usually found with the Karshu oak and the silver fir; sometimes, but more rarely, with spruce, deodar and Moru oak. In the Sikkim Himalaya it accompanies silver fir, hemlock spruce, rhododendrons and *Quercus pachyphylla*. I have not often seen it at a lower level than 8000 ft., but Brandis says that in Garhwal and Kumaon it is most common at 6–8500 ft. Sound trees are scarce, but I have seen some very fine specimens in the Darjeeling Hills; and a very large one, cut at the time of the visit of Sir R. Temple, Lieut.-Governor, to Sandukpho, in or about 1876, was quite sound. Its measurements have unfortunately been lost, but I once measured two trees, one 20 ft. in girth with a broken top, the other 16 ft. in girth with a cylindrical bole of 30 ft. ("Ind. For." i. 97). In the West Himalaya "Madden records a tree at Gangútri 100 ft. high and 15 ft. 'in girth; in the Punjab Himalaya the common size is 5 to 6 ft. in girth, in Hazara '8 to 9 ft. is not uncommon" (Brandis). In Europe it is often much larger, and Mathieu and Fliche mention two trees in England, one 45 ft. in girth and 1419 years old, another 2096 years old. Nisbet (Br. For. Trees) says that in Central Europe there are several which are 2–3000 years old.

The growth is very slow; the specimens examined varied from 12 rings (H 56, 116) to 44 rings (H 773), while E 382 showed 55 rings per inch of radius. Brandis gives 20 to 32 rings, and this perhaps is the average. Round No. H 4772 had a mean diameter of 5¾ in. for 83 rings, or 29 rings per inch.

Weight, according to Brandis, 46 to 59 lbs. per cubic foot; Mathieu Fl. For. p. 511, gives 42 to 55 lbs., the average of specimens quoted below gives 44 lbs. The wood is used for bows, carrying poles and native furniture, and if more common would probably be more extensively used, as it is very strong and elastic, and works and polishes beautifully. It requires long seasoning, however, for if used at all green it is liable to warp. In some parts of the Himalaya and the Khasia Hills it is held in great veneration and called *Deodár* (God's tree). The wood is burnt as incense, the branches are carried in religious processions in Kumaon, and in Nepal the twigs are used to decorate houses at religious festivals. In Bashahr and Tehri the sheep-graziers make small baskets of it for feeding sheep. The bark is used in Kunawar as a substitute for, or mixed with, tea; the berries are eaten and the leaves are exported to the plains and used as a medicine. In Europe they are considered poisonous, but are not always so, as goats, rabbits and sheep are said to eat them with impunity (mostly after Brandis).

The young plant requires shelter and thrives in deep shade; it consequently will not reproduce where the forest has been cleared. It flowers in spring, the young leaves appear almost immediately after, and the fruit ripens in autumn. It may be hoped that in the working of the Himalayan Forests such an interesting tree will be protected, both from being cut in the regular coupes, and from being barked and otherwise damaged by villagers. The bark is so thin that fire would probably be

immediately fatal, but luckily fires are rare in the rather moist localities which the Yew frequents.

			lbs
H	161.	Hazara, 8000 ft.	41
H	921.	„ „ (Baden-Powell)	43
H	895.	Murree „ „	40
H	116.	Jagatru, Kulu, 8000 ft. (Col. Stenhouse)	41
H	773.	Chanota, Ravi, 7500 ft. (W. Pengelly)	43
H	18.	Matiyana, Simla, 9000 ft.	46
H	56.	Hattu, Simla, 9500 ft.	50
H	2865.	„ „ „ (Gamble)	47
H	422.	Mohna Block, Deoban, 8000 ft. (Bagshawe)	43
H	4772.	Balcha, Tehri-Garhwal, 9000 ft. (Gamble)	52
E	382.	Tonglo, Darjeeling, 9000 ft. (Johnston)	46
E	3671.	Rimitti Spur, Darjeeling, 9000 ft. (Gamble)	—
E	796.	Khasia Hills, 5000 ft. (G. Mann)	45
		Nordlinger's Sections, vol. I.	

7. DACRYDIUM, Soland. *D. elatum*, Wall.; Fl. Br. Ind. v. 648; Kurz For. Fl. ii. 499 (*Juniperus elata*, Roxb. Fl. Ind. iii. 838), is a large evergreen tree of the Malay Peninsula, said by Kurz to occur in Burma, probably in Tenasserim.

TRIBE IV. PODOCARPEÆ.

8. PODOCARPUS, L'Hér.

Three species. *P. cupressina*, Br.; Fl. Br. Ind. v. 650. Vern. *Tampyu*, Kachin, is a lofty tree found at Bhamo by Griffith and by H. N. Thompson on the low hills bordering the Hukong Valley in Upper Burma. It extends to the Malay Peninsula and the islands, and in Java is called "*Chomoro*," and grows to a very large size, often 180 ft. in height, giving an excellent timber.

P. elongata, L'Hér., is a common and important tree of the Cape of Good Hope, known as "Outeniqua Yellow-wood."

1. **P. latifolia,** Wall.; Fl. Br. Ind. v. 649; Bedd. Fl. Sylv. t. 257. *Nageia latifolia*, Kurz For. Fl. ii. 500. Vern. *Soplong*, Khasia; *Nirambali*, Tinnevelly; *Karunthumbi*, Kader; *Thitmin*, Burm.

A large evergreen tree. *Wood* grey, aromatic, moderately hard, even-grained. *Annual rings* faintly marked or not marked. *Medullary rays* extremely fine, very numerous. No vertical resinous ducts.

Khasia Hills at 3000 ft.; tropical forests of the hills of Martaban and Tenasserim; Tinnevelly Ghâts at 3–5000 ft.

The only coniferous tree of the Indian Peninsula.

			lbs.
B	569.	Tonghoo, Burma (Ribbentrop)	33
W	4298.	Tinnevelly (Brazier)	32

2. **P. neriifolia,** Don; Fl. Br. Ind. v. 649; Brandis For. Fl. 541; Gamble Darj. List 83. *Nageia bracteata*, Kurz For. Fl. ii. 500. Vern. *Gúnsi*, Nep.; *Dingsableh*, Khasia; *Jinari*, Cachar; *Thitmin*, Burm.; *Welimadá*, And.

A large evergreen tree. *Bark* greyish-brown, thin, fibrous, peeling off in narrow flakes. *Wood* light yellow or yellowish-grey, homogeneous, even-grained, soft to moderately hard. *Annual rings* distinct though faint. *Medullary rays* very fine, numerous. No *resin-ducts*, but scattered cells with resin prominent on a thin section.

Eastern Himalaya, in Nepal and Sikkim, up to 2000 ft.; Khasia Hills, Eastern Bengal and Chittagong; forests of Martaban and Tenasserim in Burma; Andaman Islands.

The Thitmin, or "Prince of Woods," is justly esteemed in Burma, and is of considerable importance in the Andamans. Brandis, in Burma List, 1862, No. 94, says the stems are not very regularly shaped, and that the tree reaches 6 ft. in girth, with 20 ft.

length of bole. The log, however, sent from the Andamans for the Paris Exhibition of 1878 was larger than this and very straight; while the list of Andaman woods sent to the Calcutta International Exhibition of 1883–84 says it gives spars up to 60 ft. and is plentiful.

The growth is slow, about 15 rings per inch of radius. Weight: Brandis gives 50 lbs., the Calcutta List 42 to 45 lbs., Bennett 34 lbs., specimens examined 39 lbs.; probably the best average to take is 42 lbs. Bennett gives P = 588. The wood is used in general carpentry and is excellent to work, but would probably not resist white ants; it is also employed for oars, spars, masts and to make tea-boxes (Calc. Exh. List). Heinig says it squares up to 35 ft. in length with 15 in. of siding. It seasons well, and does not warp or shrink. Dr. Mason says, "It is used by carpenters for various 'purposes, and the Burmese have a superstition that the beams of balances should be 'made of it." Major Berdmore says that a peg driven into a house-post or boat averts evil.

		lbs.
E 1277.	Cachar	38
B 508.	Andaman Islands (General Barwell, 1878)	37
B 2265.	" " (Major Ford, 1866)	39
B 2556.	" " (A. L. Home, 1874, No. 80)	41
	Nordlinger's Sections, vol. 5 (Tab. XVI. 2).	
	" " " 10 (*P. bracteata*, Bl.).	

Tribe V. ARAUCARIEÆ.

Cunninghamia sinensis, Br. is a large tree of Southern China, which can be grown in India. It does well at Dehra Dún, and can easily be propagated by cuttings. It has been much planted at Hongkong.

Agathis loranthifolia, Salisb.; Fl. Br. Ind. v. 650, is a large tree of the Malay Peninsula and Islands. It is much used for avenues in Java, and gives the resin called "dammar." *A. australis*, Salisb. is the Kauri pine of New Zealand.

Araucaria contains about 10 species, most of which have been introduced into and cultivated in gardens in India. *A. imbricata*, Pavon is the curious "Monkey-puzzle" tree, native of Chili, but common in English gardens. *A. excelsa*, R. Br., from Norfolk Island, is much planted in Calcutta, where also may be seen *A. Cunninghamii*, Ait., from Queensland, *A. Cookii*, R. Br., of New Caledonia and *A. Bidwilli*, Hook., the "Bunya-Bunya" pine of North-East Australia.

E 3720 is *A. Cunninghamii*, from a tree blown down in 1881 in the Royal Botanic Garden, Calcutta. The *wood* is soft, light yellow and the *medullary rays* fine, prominent, but scanty and irregular (also Nordlinger's Sections, vol. 8).

E 4734 is *A. Cookii* from the same place. *Bark* rough, with horizontal lines. *Wood* grey with a reddish-brown heartwood, soft. *Annual rings* not apparent. *Medullary rays* moderately broad, not very numerous, but causing a marked silver-grain on a radial section. W = 36 lbs.

Tribe VI. ABIETINEÆ.

Pseudotsuga Douglasii, Sab. is the well-known "Douglas fir," so largely planted of late years in Europe. It is found in large forests on the Pacific coast of North America and gives an excellent timber. It ought to do well in suitable soils and at a suitable elevation in the Indian hills.

9. PINUS, Linn.

Five species indigenous in India, there being altogether about 70 known. The European species are, many of them, very important:—

P. sylvestris, Linn. is the Scotch pine, which gives the timber known as Red Memel, Dantzic fir and Red Deal of the Baltic. *P. Pinaster*, Soland. (*P. maritima*, Lamk.) is the Maritime or Cluster pine so largely used in reclothing sandy wastes on the seashore like the "Landes" of Gascony, and for the production of resin. *P. halepensis*, Mill. is the Aleppo pine found throughout the Mediterranean region, chiefly on limestone. *P. Laricio*, Poiret gives two varieties, called respectively the Corsican pine and the Austrian pine, which are also used for the production of resin and for replanting barren soils. *P. Pinea*, Linn. is the Stone pine of Italy, with edible fruits, and *P. Cembra*, Linn. the "Arolle" of the mountains of Central Europe.

Of the American pines the most important is *P. Strobus*, Linn., the White pine or Weymouth pine, whose wood is extensively used in America and is exported to Europe from the forests of Canada.

Some of these are occasionally cultivated in India, the chief being the Cluster pine, which has been planted on the Nilgiris and does well at various places in the Himalaya, as at Chakrata. It is well worth more extensive cultivation, both for its timber and for resin.

Wood generally very resinous, not homogeneous, consisting of alternate layers of soft and often spongy spring wood, and of hard and darker coloured autumn wood; heartwood distinct. *Medullary rays* fairly numerous, rather irregular, fine to moderately broad. Vertical *resin-ducts* large and numerous, in most species visible on horizontal and vertical sections.

1. **P. excelsa**, Wall.; Fl. Br. Ind. v. 651; Brandis For. Fl. 510; Gamble Darj. List 83. The Blue pine. Vern. *Piuni*, Afg.; *Nukhtar*, Kuram; *Biár*, Hazara; *Chil, chír, chiltu, chítu, chiú*, Kashmir to Jaunsar; *Chíla*, Garhwal; *Kail*, Beas, Sutlej; *Lim*, Chamba, Kunawar; *Yara, yúr, yiro, kairu, kair*, Kashmir; *Shomshing, limshing*, Lahoul; *Raisalla, lamshing, durrasalla*, Kumaon; *Tongschi*, Bhutan.

A large evergreen tree. *Bark* greyish-brown, cut into small rather regular plates by shallow fissures ¼ in. thick. *Wood* moderately hard: sapwood white; heartwood light red. *Annual rings* marked by the denser autumn wood with more compressed tracheids and much smaller lumina. *Medullary rays* fine, numerous, rather irregular, causing a silver-grain on a radial section. *Resin-ducts* scattered, fairly numerous, prominent on all sections.

Temperate Himalaya at 6-12,500 ft., extending westward to Kafiristan and Afghanistan; and eastwards, except for gaps in Central and North-West Kumaon and Sikkim, to Bhutan.

The Blue pine belongs to the *Strobus* section of the pines, with 5 to 8 needles in a cluster and cylindrical soft-scaled cones. It resembles the Weymouth pine, but has much longer leaves and larger cones. It is found either gregarious or mixed with other trees, such as the Deodar. At high levels it is found with the birch and silver fir, at low levels with the Long-leaved pine. On the edges of forests, fallow lands and scrub lands soon get covered with Blue pine seedlings if seed-givers are near, and these grow up into dense gregarious belts. If any deodar seed-bearers are also at hand, deodar seedlings come up with the Blue pine, but are soon suppressed, as the Blue pine grows so much faster. It is therefore necessary to make thinnings to assist the deodar if it is required that the eventual forest should be of deodar or with a good proportion of deodar among the pine. The Blue pine reaches a height of 100 to 120 and even 150 ft., with a girth of 6 to 10 and perhaps 12 ft. It is a light-lover, and rarely if ever comes up in shade. If grown in pure forests, it can be treated, like the Scots pine in Europe and the Long-leaved pine, by a heavy seed-felling and breaking up of the soil, to be followed by a final felling when the seedlings have come up and are strong enough. The flowers appear in spring and the fruit ripens in the autumn of the following year, so that it is not unusual in spring to see fruit in three stages at succeeding verticils of a branch: (i.) the minute new cones at the last joint; (ii.) the small green year-old cones at the next; and (iii.) the dry open cones, which have shed their seed the autumn before at the third from the end. The male and female flowers are usually on separate branches, but catkins are occasionally found bearing both male and female flowers.

Blue pine seedlings are easy to rear in nursery if it is remembered that they stand pricking out and transplanting badly. It is best, therefore, to put them in baskets at an early stage and use the baskets in planting; otherwise they must be taken out with balls of earth so as to avoid disturbing the roots.

The growth of Blue pine varies, naturally, according to the locality in which it is found. In good soil at a moderate elevation it grows very fast, perhaps having 4 to 5 rings per inch of radius. At high elevations and on rocky ground, the growth will be

slow, perhaps 20 to 25 rings per inch. The rate of growth, therefore, and the rotation to be adopted in working, require to be ascertained for each locality under consideration, but at a moderately high elevation in a good climate and with good soil the rotation will usually not be longer than 100 to 120 years. It prefers sandy or clayey soils rather than limestone.

The timber given by the Blue pine is good, better than that of the Long-leaved pine and next in estimation to that of the deodar. It is very largely used in construction throughout the West Himalaya, especially in Kashmir and the Punjab, and is much exported to the plains. It floats well and does not soon get waterlogged. It gives good railway sleepers, but as they are much inferior in durability to those of the deodar, they ought to be first creosoted. For planking, doors, windows and furniture it is better than deodar, as it is not so brittle, has not the oil which in the deodar so readily absorbs dirt, and is free from the strong scent. In Kangra and Kulu it is used for tea-boxes (L. G. Smith). Resinous wood is used for torches, and the leaves are cut for litter. It gives an excellent resin, less freely than the Long-leaved pine, but the turpentine and colophany produced are of slightly better quality. The tapping is done by vertical cuts as in the case of the Long-leaved pine. The trees are tapped, with usually two cuts on opposite sides, for about 3 years, and are then allowed 3 years' rest, after which tapping can recommence on another side, and so on. Tapping to death (*gemmage à mort*) has been tried, with comparatively young trees that it was proposed to kill for the sake of underplanted deodar, but it did not succeed in killing the tree, and the amount of resin obtained was not great. There is no reason to suppose that moderate tapping injures the tree; on the contrary, in all probability it improves the timber.

Dr. Warth's analysis of the wood ash, of which he found only 0·14 lb. in 100 lbs. steam-dry wood, showed that the principal salts were carbonates of calcium and magnesium with smaller quantities of potassium and sodium compounds, phosphates of iron and calcium and silica. The experiments of Messrs. Leather and Collins showed that the calorific power of Blue pine was 96·92 against 100 for pure carbon; also that in 100 lbs. of wood 97·10 lbs. were carbon and other organic matters, 2·55 per cent. moisture and 0·35 per cent. ash. One pound of wood evaporated 14·56 lbs. of water at 212° Fahr.

The origin of the manna-like substance occasionally found on the leaves of the Blue pine, which is eaten and found sweet and palatable, has not yet been fully determined. It was described by Major Madden as having been abundant in the winter of 1844–45, and Capt. Hay informed him that it was due to a species of *Aphis* (cf. B. H. Baden-Powell in Ind. For. i. 55).

The Blue pine has, so far as is known, but few insect enemies. Dead trees show the tunnels of species of *Scolytus*, and girdled trees in Jaunsar have been found pierced, in the bark and outer sapwood, by small beetles of the genus *Polygraphus* (Stebbing, "Inj. Insects," p. 63).

In respect to fungoid enemies, also, there are but few. The only one so far recorded is *Peridermium orientale*, Cooke (*Æcidium brevius*, Barcl. in Jour. As. Soc. Beng. lix. ii. 102), which occurs as little orange-coloured sacs of spores on the needles of the trees, but does really very little harm, except in the condition called var. *corticola*, when it kills off the branches (see "Ind. For." xxv. 435). A worse enemy is the minute Loranthoid parasite *Arceuthobium minutissimum*, Hook. f. in Fl. Br. Ind. v. 227, which Mr. J. F. Duthie found covering the stem and branches of Blue pine in the Kumaon Himalaya and doing great damage (see p. 584). Pandit Keshavanand has also found it doing much harm in the Ganges portion of Tehri-Garhwal, but so far I have never met with it in the Jumna Valley region, though I have kept a good look-out for it.

		lbs.
H 923, 901.	Hazara, 7000 ft. (B. H. Baden-Powell)	29 and 30
H 140.	Lahoul, about 10,000 ft. (Rev. Mr. Heyde)	26
H 609.	" " " (W. Pengelly)	27
H 37.	Mashobra, Simla, 7000 ft.	33
H 2871.	Nagkanda " 8000 ft. (Gamble)	—
H 1403α	Punjab Hills, Dr. Stewart (1867)	32
H 1403β	Punjab Hills, Dr. Stewart (1867)	32
H 1404.	Punjab Hills, Dr. Stewart (1867)	33
H 1407.	Punjab Hills, Dr. Stewart (1867)	28
E 2468.	Chumbi Valley, Tibet, about 10,000 ft. (Schlich)	30
	Nordlinger's Sections, vol. 8.	

2. **P. longifolia.** Roxb. Fl. Ind. iii. 651; Fl. Br. Ind. v. 652; Brandis For. Fl. 506; Gamble Darj. List 83. Long-leaved Pine. Vern. *Nukhtár*, Afg.; *Chīl, chír, dráb chir*, Pb.; *Gúla, thansa*, Kangra; *Anander*, Jhelum; *Shti*, Sutlej; *Siral, sirli, kalhain*, Jaunsar; *Chír, salla, sapin, kolon, kolan, kolain*, Garhwal and Kumaon; *Salo*, Dotiál; *Dhúp*, Oudh; *Dhúp, sala dhúp, sula*, Nep.; *Gniet, nyit*, Lepcha; *Teadong, tang*, Bhutia.

A large, more or less deciduous, tree. *Bark* 1 to 2 in. thick, reddish-brown outside, dark red within, cut by deep fissures into large plates of irregular size, but more or less rounded, and on an average about 6 in. across. (In the Sikkim tree, the bark is thinner and the plates smaller.) *Wood* moderately hard: sapwood white; heartwood light reddish-brown. *Annual rings* very distinct. *Medullary rays* fine, numerous, rather irregular. *Resin-ducts* large, numerous, irregularly distributed, prominent on vertical sections.

Outer Himalaya and Siwalik Range, also valleys of principal Himalayan rivers, at 1500–7500 ft.; extending west to Afghanistan and east to Bhutan, but in the east it rarely rises to over 3000 ft.

The long-leaved pine is an eminently gregarious tree forming pure forests everywhere that it is found in the West Himalaya. Some of these forests are of great extent; that of the Tons Valley, the chief tributary of the Jumna, for instance, forms a sheet of perhaps 100 square miles, from the mouth of the Rupin down to that of the Pabar and even further. The forest is naturally best on slopes with a northern aspect and where the soil is good. There are also large forests in various parts of the Punjab and in Garhwal and Kumaon. In Sikkim the forest is not always pure, but the pine is much mixed with Sál and other trees; in fact, it has the appearance of being slowly driven out. The tree can be planted and will thrive in most places in the Indian plains, even in Calcutta.

The long-leaved pine is a very fine and stately tree, with long (9 to 10 in.) needles in clusters of 3 and large woody cones. In age it has a tall, usually somewhat curved, but often straight bole, surmounted by a few large horizontal branches bearing a rounded head. The trees with twisted stems, so common in parts of Kumaon, are useless for timber, as the twist may be found in the planks and pieces cut. The cause of the twist is not fully understood. Chir reproduces admirably from seed wherever the forest is protected from fire, better, of course, if the thick carpet of grass and dry needles is more or less removed to allow the seed to reach the ground. But even when that carpet is left and there is ample light, it is wonderful how good the reproduction is, the seed managing somehow to work its way down. Moderate grazing is rather beneficial than otherwise. It is probably the most completely light-loving, not only of Indian conifers, but of the principal Indian forest trees. In treatment it resembles the Scotch pine, and the best method is to make a heavy seed-felling, leaving only a few well-distanced good seed-givers, and to stir up the soil where the works of conversion have not done this sufficiently. If fire-protection is fully assured—and without fire-protection proper management is hopeless—a complete new crop may be confidently looked for within a very short time, and then a final felling can clear away the seed-giving scattered trees, which are best removed, unless small enough to be capable of remaining for a whole rotation. The system of restricting fellings to trees above a certain girth, such as 6 ft., has not been very successful in practice, as it has in many cases led to poor and unequal reproduction, and sometimes to none at all. The size of exploitable trees depends entirely on soil and climate, and trees are often fully mature and fit to cut on poor soil at a less girth than 6 ft., so that it is a mistake to leave them for another rotation. The flowers appear in early spring, producing enormous quantities of pollen, and the fruit ripens in about fifteen months, the seed being usually shed in the hot season. Good seed-years come only at irregular intervals, and the forester has therefore to watch and take advantage of them in ground preparation. The Long-leaved pine is easily grown in nursery, but sowings have generally been found to be more satisfactory, and much cheaper than planting transplants, for the tree has a long taproot, the treatment of which in nursery is difficult. Young trees are very hardy and will often, if cut or burnt, reproduce from the roots or from what is left of the stem, almost as coppice shoots. If transplanting is necessary, it must be done in the winter or even in the hot season rather than in the rains, for the tree will not stand wet, and the plants will die at once if at all waterlogged.

The rate of growth of long-leaved pine varies very greatly according to circumstances. In suitable places on good soil and in a forcing climate, it is very fast, and 2 to 3 rings per inch are by no means rare; in rocky exposed sites, on the contrary, it may be slow, and 15 to 20 rings per inch will be more nearly the rate. In W. E. D'Arcy's "Chamba Working Plan," the average of a large number of trees came to 11 to 12 rings per inch, and the rotation was fixed at 120 years. In J. L. Pigot's "Working Plan" for Murree and Kahuta, a faster growth was found, 6⅔ rings per inch, and 80 years was adopted as the exploitable age. For Kulu 70 years was taken. In the Tons Valley the rate varies from 4 to 12, average 8½ rings per inch, and the exploitable age fixed was 100 years. In the forests of Naini Tál and Rainkhat 13¾ and 16 rings per inch of radius proved to be the ascertained average rate of growth, and the exploitable age was fixed at 135 and 160 years respectively. In very good localities a rotation of 80 years would probably suffice to give trees of 6 ft. girth without bark, in rocky places it would have to be nearly double, so that an average of 120 years is probably likely to suit most forests where there is considerable variety of soil and climate.

The timber of the Long-leaved pine is not so good as that of the Blue pine, but it is by no means bad, and is in very considerable demand. In his "Hints on Arboriculture in the Punjab," Ribbentrop says: "I am convinced that this tree will yield 'the greatest net money return when once we begin to impregnate;" and I am disposed to endorse this and to express the opinion that when the convenient situation of the forests, the easy reproduction of the tree and the easy extraction of the timber are taken into consideration, it ought to be from properly creosoted Long-leaved pine wood that the Indian railways should be chiefly supplied with sleepers, for the supply of deodar wood is not sufficient alone. The wood floats fairly well, and is chiefly extracted in the form of "Karis" or small beams of section 5″ × 5″ or 5″ × 4″, for use in building in the plains districts bordering on the Himalaya. The wood is used in building houses and boats, for making tea-boxes, shingles, etc. The wood of the Sikkim trees is heavier, harder and stronger, more durable and of better general quality than that of the North-West.

Regarding the weight and transverse strength of Chír wood the following experiments have been made:—

Captain Jones at Almora in 1844—

	Weight in lbs.	P=
15 experiments, unseasoned wood, 4′ × 2″ × 2″, gave	39	626
5 ,, seasoned ,, ,, ,,	38	645

Experiments at Roorkee in 1858 on Garhwal wood by Colonel Maclagan, R.E.—

	Weight in lbs.	P=
3 experiments, with bars 22′ × 1″ × 1″ . . gave	37	906
4 ,, ,, ,, 34′ × 1″ × 1″ . . ,,	27	961
4 ,, ,, ,, 34′ × 2″ × 1″ . . ,,	27	916

The specimens enumerated below give an average of 40 lbs. per cubic foot for northwest wood, and 42 to 43 lbs. for Sikkim wood, which is, perhaps, correct.

The Long-leaved pine is the chief tree tapped for resin, chiefly because it is found in much larger numbers than the Blue pine, but also because it yields a larger amount. The tapping for resin was commenced, in a systematic manner, in Jaunsar, but it has been now extended both to the Punjab on the west and to the forests of Kumaon on the east. In 1888–89 about 9600 trees were tapped in Jaunsar, each giving about 8¾ lbs. of resin. The total yield of the year was rather over 1000 maunds (1 md. = 80 lbs.), and this produced, at the Forest School Factory at Debra Dún, about 900 maunds of colophany and 1740 gallons of turpentine, which sold for nearly Rs.9000. The profit was about Rs.1 13a. per maund of crude resin. In good seasons, a tree will generally give about 12 lbs. of resin. The tapping is done in two vertical cuts, one on each side of the tree, and after 3 years' tapping, rest is given for another 3 years, when tapping can recommence. The tapping does not injure the timber; it rather improves its quality. The colophany sells chiefly for soap manufacture; the turpentine is in great demand for various industries, but chiefly in railway workshops. The manufacture of turpentine and colophany is described in "Ind. Forester," xxvi. 497, by Babu Birbal, the Ranger in charge of the work. The roots of felled trees can also be utilized in the manufacture of tar. In Jaunsar, tar has been systematically manufactured

in closed masonry kilns. Each kiln (at Thadiar) holds 15 maunds, which usually gives 1¼ maunds of tar and 6 maunds of charcoal. The tar is then boiled down into pitch and exported to the plains for sale. The industry only requires to be better known, to produce a better demand than at present exists. Experiments on the calorific power of the wood, made by Messrs. Leather and Collins at Dehra Dún, showed that the wood of the Long-leaved pine had a calorific power of 97·85, that of pure carbon being 100. The wood contained 94·65 per cent. carbon and organic matter, 4·15 per cent. moisture and 1·20 per cent. ash. One pound of wood evaporated 14·78 lbs. of water at 212° Fahr. Dr. Warth's experiments showed that 100 lbs. of steam-dry clean wood gave 0·33 lb. of ash, mostly calcium carbonate (0·12 lb.) and silica (0·16).

The bark is sometimes used in tanning leather, the skins being steeped in a decoction of it for 3 or 4 days. But experiments at Dehra Dun showed that the amount of extract given was quite small. The wood is not a good fuel, and burnt in a grate it is said to be troublesome in giving out sparks. It gives, however, a fair charcoal, and the charcoal of the leaves mixed with rice-water makes ink.

The Long-leaved pine has some insect enemies. The Curculionid beetle, *Astycus lateralis*, Fabr., tunnels into the wood and renders it unfit for timber, and various Scolytid beetles are also destructive. Small grasshoppers of the genera *Caloptenus, Chrotogonus, Catantops* and *Ædalus* destroy the leaves of seedlings in the nurseries of the Baldhoti Plantation, North-Western Provinces.

Like the Blue pine, the Long-leaved pine is injured by the fungus *Peridermium orientale*, Cooke (*Æcidium complanatum*, Barcl.), a species which forms small orange-coloured sacs of spores on the needles of the trees. In this state it does but little harm, but when the fungus attacks the branches, in the state known as var. *corticola*, the damage is considerable (see "Ind. Forester," xxv. 435).

The forests of Long-leaved pine in the Western Himalaya have a great future before them if properly managed, but the first essential to that management is permanent and complete protection from fire.

		lbs.
H 602.	Tuttul Forest, Kangra (W. Pengelly)	37
H 13, 93.	Simla, 6000 ft.	39
H 3003.	Garhwal (Brandis, 1874)	45
E 704.	Badamtam Forest, Darjeeling, 2500 ft. (Manson)	45
*E 2435.	Great Rangit Valley „ 2000 ft. (Gamble)	42
E 2436.	Darjeeling, 7000 ft. (planted) (Gamble)	—
	Nordlinger's Sections, vol. 7 (Tab. XVI. 3).	

3. P. Khasya, Royle; Fl. Br. Ind. v. 652; Brandis For. Fl. 508; Kurz For. Fl. ii. 499. Khasia Pine. Vern. *Dingsa*, Khasia; *Tinyu*, Burm.; *Taru*, Shan.

A large evergreen tree. *Bark* thick, with deep cracks. *Wood* very resinous, moderately hard, pale brown to red. *Annual rings* very distinct. *Medullary rays* fine, numerous, irregularly distributed. *Resin-ducts* moderate-sized, numerous in the outer and middle belt of each annual ring, prominent on vertical sections.

Khasia Hills, hills of the Lushai country of Chittagong, Shan Hills and hills of Martaban in Burma, at 3–7000 ft.

The Khasia pine forms gregarious forests, but is not of large size in the Khasia Hills, though in Burma it may reach 100 ft. (200 ft.! Fl. Br. Ind.), with a girth of 10 ft. or more. The growth is moderately fast; the specimen examined showed 6 rings per inch of radius. In an account of the firs of the Khasia Hills by Captain Jones of the Quartermaster-General's Department in "Gleanings of Science," vol. i. p. 202. 1829, the weight determined by Captain Baker, but with small bars 15″ × 0·8″ × 0·9″ is given as 37 lbs., and the value of P 522. The wood is extensively used in the Khasia Hills for building and other purposes. It is very rich in resin. G. Mann says that in the bazars of the Khasia Hills a very resinous wood is sold, which is used by the natives as well as by Europeans for kindling fires. It is produced artificially by cutting a hole in the lower part of the trunk and removing the bark and a little of the wood from just above it. The result is that the wood above the hole gets saturated with resin and is cut out. This resinous wood is also used for the extraction of crude turpentine ("Ind. Forester," vii. 125).

The pine forests of Burma were examined and reported on in 1897, and from these Reports it appears that the area of Khasia pine forest is from 100 to 200 square miles,

the most extensive areas being those in the Shan States and in the Chindwin Valley. Mr. Nisbet found good forest at Kalaw, and reported that, though not tapped for resin, the trees were charred at the base and pieces saturated with resin cut out and sold in bundles for fire-kindling. He mentions that natural reproduction is good, the only help required being efficient protection from fire. Mr. J. Copeland found it on the crests of the ridges in the Mandalay Division, but only in small clumps; also in forest in the Thibaw State. He found, by valuation survey, partly in pure partly in mixed forest, on 16 acres, 512 trees under 2 ft. girth, 584 trees from 2 to 4 ft. girth, 350 trees from 4 to 6 ft., and 20 trees over 6 ft. in girth. He ascertained, also, that at 72 years of age average trees reached 6 ft. in girth and a height of 100 ft. The wood was only used as kindling sticks. In the Southern Shan States, Mr. H. N. Thompson found a considerable area of forest of Khasia pine, with many trees over 6 ft. in girth and boles reaching 20 to 30 ft. without branching. The wood was only used as torches and kindling sticks, and occasionally for planking in native monasteries and rest-houses, but it was not durable. Mr. A. E. Ross found considerable areas in the Mongpu, Monghsat and Monglun States, worked only for kindling sticks.

In that beautiful work "Burma," by Max and Bertha Ferrars, the region of this pine is given as up to 10,000 ft. The authors say that the undergrowth of the pine forests consists of *Saccharum* grass, and when this catches fire large areas of pine are destroyed.

The crude turpentine of the Khasia pine has been examined in London by Prof. Armstrong, F.R.S., and pure turpentine of good quality distilled from it. It is probable that the turpentine and colophany yielded are quite as good as those obtained from the Long-leaved and Blue pines, but the area of forest is too small to make the industry even one of much importance in Assam, and in Burma the distance from the rivers and coasts of the chief forests seems to preclude its profitable extraction.

		lbs.
E 797.	Khasia Hills (G. Mann)	38

4. P. Gerardiana, Wall.; Fl. Br. Ind. v. 652; Brandis For. Fl. 508, t. 67. Himalayan Edible Pine. Vern. *Chilghoza, jalghoza,* Afg.; *Chiri, prita, mirri, galboja, galgoja,* Chenab; *Kashti,* Ravi; *Ri, rhi, ree,* Kunawar; *Kannuchi, koniúnchi, kanin-chi, shangti,* W. Tibet; the seeds, *neoza.*

A moderate-sized evergreen tree. *Bark* very thin, grey, smooth, exfoliating in large thin scales, leaving rounded shallow depressions, cracked only in very old trees. *Wood* hard, very resinous; heartwood yellowish-brown. *Annual rings* distinct. *Medullary rays* fine, not numerous. *Resin-ducts* scattered, moderately large, prominent on vertical sections.

Inner dry and arid West Himalaya, from the Niti Pass in Garhwal westwards, found in isolated areas of no great extent, generally between 6000 and 10,000 ft.; mountains of North Afghanistan and Kafiristan; Hariáb District at 7–11,000 ft.

The Himalayan edible pine is gregarious on dry, steep, rocky slopes, on granite or clay slate especially, in the inner valleys beyond the reach of the south-west monsoon. It does not form dense forests, but is common over large areas. It reaches a girth of 6 to 7 ft., occasionally 12 ft., and a height of 30 to 40 ft., or occasionally more. Thomson ("W. Himalaya and Tibet," p. 74) says of it, "It is a compact small tree, 'with much twisted ascending branches and a mottled grey bark, quite smooth from 'the decortication of the outer layers."

The growth is moderate, Stewart's specimen showed 13 rings per inch of radius. The wood, according to Brandis, "is used for the hook which supports the passenger's 'seat on the single-rope swing-bridge; it probably is tough, but the tree is hardly ever 'felled, as it is valuable on account of its edible seeds." The bark is made into baskets and rough water-buckets.

The seeds are a staple article of food in Kunawar and other parts of the Himalaya; they are largely brought into India from Afghanistan. They are oily, with a slight turpentine flavour, and by Europeans are generally roasted and eaten at dessert.

		lbs.
H 991.	Kunawar, Punjab, 9000 ft.	44
H 1405.	Chenab " " (Stewart, 1867)	47

5. **P. Merkusii,** Jungh. and de Vriese; Fl. Br. Ind. 652; Kurz For. Fl. ii. 499. Vern. *Tinyu*, Burm.

A large evergreen tree. *Bark* thick, rough. *Wood* moderately hard, very resinous; heartwood yellowish-brown with dark streaks. *Annual rings* very distinct, zone of autumn wood nearly as broad as that of spring wood. *Medullary rays* fine, fairly numerous, long. *Resin-ducts* fairly numerous, moderate-sized.

Hill forests of the Shan States, Martaban and Tenasserim at 500–3500 ft.

This pine of the Malay Archipelago and Peninsula finds its northern limit in the hills of Burma, where it is chiefly found in the Southern Shan States, the hill Eng forests along the Salween river, and in those of the Thaungyeen. In Sumatra, it grows to a height of 100 ft., but in Burma it scarcely attains 60 ft. in height and a girth of 6 ft. H. N. Thompson, however, mentions trees of larger size in the Shan Hills, and says that they are generally found growing in very hot, dry forests of *Ingyin*, *Thitya* and *Thitsè*, and occasionally in Engdeing. This pine does not, however, form pure forests as does the Khasia pine. A. E. Ross found it fairly common in the Mongpu State. The forests are of quite small extent, so that its use as a timber and as a yielder of resin and turpentine is not likely to be of importance. Its growth is moderately fast, about 11 rings per inch of radius. The wood is heavy; Seaton gave 54 lbs., the specimens examined 51 lbs. The wood has sometimes been brought to Moulmein in the form of mast pieces, but the difficulties of extraction and transport are great. Splinters of the wood are used as torches, and the resin and turpentine are of excellent quality. See Prof. Armstrong's Report to the Imperial Institute.

	lbs.
B 547. Thaungyin, Burma (Col. Seaton)	51
Nordlinger's Sections, vol. 10.	

10. CEDRUS, Loud.

1. **C. Libani,** Barrel., var. *Deodara*, Hook. f.; Fl. Br. Ind. v. 653; Gamble Darj. List 83. *C. Deodara*, Loudon; Brandis For. Fl. 516. *Pinus Deodara*, Roxb. Fl. Ind. iii. 651. Deodar. Himalayan Cedar. Vern. *Nakhtar*, *Imanza*, Afg.; *Diár*, *deodár*, *dedwar*, *dadár*, Hazara, Kashmir, Garhwal, Kumaon; *Palúdar*, Hazara; *Kelu*, *keoli*, *kilar*, *kilei*, *kilai-diár*, Chenab to Jumna; *Kelmang*, Kunawar; *Giam*, Tibet; *Kelon*, Jaunsar; *Thingu*, Dotiál.

A very large evergreen tree. *Bark* greyish-brown, with numerous rather shallow, vertical fissures, which run into each other and give a reticulate appearance. *Wood* moderately hard, strongly scented, oily: sapwood white; heartwood light yellowish-brown. *Annual rings* distinctly marked by the darker autumn wood. *Medullary rays* fine, unequal and irregular, fairly numerous, not deep, causing a silver-grain of small plates. *Resin-ducts* none, the oil contained in wood-cells in the heartwood.

Western Himalaya, extending westwards to the mountains of Afghanistan; eastwards to the Dauli river in Kumaon, at 4–10,000 ft., most common at 6–8000 ft. Often planted in hill stations and their neighbourhood, and in some plains localities in North-West India, as well as in Europe and America.

The Deodar, for which perhaps it would be more convenient, for forest purposes, in citing the scientific name, to use the better-known one of *C. Deodara*, is the principal timber tree of the Himalaya, giving the most important and valuable of the timbers of Northern India. It is a gregarious tree, forming fine forests in the valleys of the Punjab and Kashmir, as well as in those of the Tons, Jumna and Bhagirathi, ending up in the watershed of the Alaknanda. The forests are rarely of pure deodar, though exceptions are met with occasionally and usually in the form of sacred groves; but more often the deodar is associated with the spruce and blue pine and the three oaks *Kharshu*, *Moru* and *Ban* in their various zones. Sometimes the silver fir (*Abies Pindrow*) accompanies it, but more rarely; the cypress in its favourite localities joins it; the yew is often found under it; and at low elevations it mixes with the Long-leaved

pine. Among other trees commonly found with deodar may be mentioned the birch (*Betula alnoides*), poplar (*Populus ciliata*), horse-chestnut, elm, hazel, hornbeam, maples, bird-cherry, holly (*Ilex dipyrena*), *Pieris ovalifolia* and rhododendron; while among shrubs which are commonly found in deodar forests may especially be noted species of *Berberis*, *Indigofera*, *Desmodium*, *Cotoneaster*, *Euonymus*, *Salix*, especially *S. elegans*, *Viburnum*, *Lonicera*, *Parrotia*, and rose, while *Clematis montana* and *Vitis semicordata*, with the ivy, are frequently met with climbing over it and festooning its branches. In the outer ranges, the deodar forests clothe chiefly the northern and western slopes of the ridges, while in the more inner ones to which the rainfall of the south-west monsoon still reaches, they are found at all aspects but less pure. Beyond the region of the south-west monsoon, deodar is still found, but it gets gradually scarcer, and in such places its companions may be *Pinus Gerardiana* and *Quercus Ilex*.

The male and female flowers of the deodar are found, as a rule, on separate individuals, but this is not always the case, and monœcious trees are often met with (see "Ind. For." xxv. 246). The pollen is shed at the end of the rainy season, in October, and the young female cones, which have then their scales open, get fertilized, and their scales close. During the winter they increase but little in size, but with the advent of spring growth becomes fast, and the cones are mature in October and November, when they break up and discharge their winged seeds. Good seed years come irregularly, roughly speaking, about once in four or five years. In suitable localities, where the seeds can get through the grass and weeds and moss of the surface covering, reproduction is very prolific, and where not interfered with by fire or cattle or a severe drought, the young trees grow fast and well. On the edges of forests where there are seed-bearers of both deodar and blue pine, the young growth of both comes on in mixture, but as the blue pine grows faster than the deodar, artificial assistance is required to prevent the deodar being ousted, and this has to be given by degrees as they grow up together. Where, as often happens, the deodar is associated with white oak and rhododendron, it is astonishing how little the young trees object to the shade; indeed, they seem to like it, and will in time pierce right through the foliage of their nurses. It is best, however, to help them, and this is done usually by girdling the oak, etc., so that they may die gradually and not damage the deodar, as might happen if such heavy-branched trees were felled green. It is best, however, to lop the oak branches as much as possible, so that if the dry oak should be blown down, as little damage as possible may be done. In order to produce the tall straight branchless boles which alone give good building timber and good railway sleepers, deodar must be grown close, and only very carefully and gradually thinned until it has made a sufficient height-growth. Natural reproduction of deodar, under ordinary circumstances, and with immunity from fire and too heavy grazing, especially by sheep, is usually excellent. Artificial reproduction also is by no means difficult: deodar is easily grown in nurseries, and with care is easily transplanted; but young plants cannot stand waterlogging, and dislike being moved after the new year's shoots have started, and so it suffers if transplanted during the rainy season. Consequently, it is generally best to use baskets or to transplant with balls of earth, putting the plants out in the spring, and choosing as far as possible one of the showery days which often come at that time of year (April to May).

The treatment best suited for mixed forests of deodar and other species is probably that of a moderate seed-felling, bearing as much as possible on the other species of tree, and accompanied by a good working up of the soil. If the succeeding year turns out a good seeding year, and the new crop of young deodar comes up well, the next fellings can soon be made, and can be made heavy and in one or more operations, the last one leaving only those poles and trees which are immature, but sound and good, and capable of lasting till a new regeneration comes round. This seems to be the average procedure generally advised, but it naturally requires to be altered according to circumstances, and it is consequently important for those entrusted with the preparation of Working Plans to study very carefully the localities with which they have to deal. Much information on the subject is given in B. Ribbentrop's "Notes on the Deodar," "Ind. For." xxv., Appendix, 1899.

After the systematic working of the existing deodar forests in the Himalaya, the most important work may be said to be the filling up of blanks in those forests, naturally or artificially, and the conversion of all available waste lands and forest areas of *ban* oak and rhododendron, suitable for it, into forests of deodar.

The Deodar can reach a very considerable size. Thomson (" W. Him. and Tibet,"

p. 64) mentions one near Nachar on the Sutlej that had 35½ ft. in girth. Brandis mentions trees in Kunawar that had 30 to 36 ft. in girth; Dr. Stewart measured one at Kúarsi, in the valley of the Ravi, that was 44 ft. at 2 ft. and 36 ft. at 6 ft. from the ground, and another was ascertained to be 34½ ft. in girth, and to be about 900 years old. Minniken records a tree at Punang in Bashahr that was 150 ft. high, and had a girth of over 36 ft., the clean bole height being 45 ft. The great section in the corridor of the Imperial Forest School at Dehra Dún shows 23 ft. in girth and 665 annual rings, equivalent to about 13 rings per inch of radius; it came from the Gokul Forest in Tehri-Garhwal, and was cut by Mr. E. M. Moir. In the Moriru Forest in the Tehri-Garhwal Leased Forests, I measured in 1898 a stump—or rather shell, for the interior had decayed—that was 34 ft. in girth; while not far off, in Dumrali Block, a dry fallen tree was unearthed, 90 ft. long, and over 7 ft. in diameter at base. It had been dead for at least 100 years, and was, when it fell, probably 550 years old. When cut up, it gave 460 metre-gauge sleepers and some karis ("Ind. For." xxiv. 400). Aitchison mentions a tree in the Kuram Forests 22 ft. in girth and 150 ft. high. Schlich found a tree in the Sutlej Valley 240 ft. high; and W. R. Fisher tells me he saw one of 216 ft. in the Bashahr forests of the Pabar Valley. Deodar is probably at its best, in good localities, at about 12 ft. in girth, and in the Tehri Forest Working Plan it is estimated that an average tree gives 50 sleepers 6′ × 8″ × 4½″.

In common with most species of the Order, the Deodar has well-marked annual rings which, there is little, if any, reason to doubt, represent yearly growths. More information has, perhaps, been collected on the subject of the rate of growth of Deodar than of any other species of Indian tree, though we have as yet no such complete series of trees of known age to deal with as were available at Nilambur for the question of the rate of growth of Teak. The geographical range of Deodar, especially in altitude, is very wide, and this circumstance, considering that some specimens may be obtained from sheltered places in comparatively warm valleys, while others come from exposed and high situations, makes it doubtful whether much value can be attached to general deductions from data collected from many quarters, and whether it should not usually be the practice to take only for use in any forests, the experiments made on trees in that or neighbouring localities. Brandis gives a large amount of information, to which reference can be made. He points out that the Deodar forests may be classified in three great divisions, viz.—

(1) Those in a dry climate in the vicinity of the arid zone of the inner Himalaya, having usually the age of trees 6 ft. in girth above 140 years.
(2) Those in the intermediate ranges and valleys, having 6 ft. in girth for an age of between 110 and 140 years.
(3) Those in the outer ranges under the full influence of the monsoon and having the age of trees 6 ft. in girth usually below 110 years.

In his "Notes on Deodar Localities near Simla," 1867, Brandis mentions two trees at Naldehra which gave 9 rings per inch of radius; two trees at Gund, in the Giri Valley, which gave 12½ rings; and a tree at Cheog which had 8 rings. In the Mahasu Water-Catchment Forests, valued in 1877 ("Ind. For." v. 139) the stumps of large trees gave 9·64 rings on an average, and poles gave 8 rings. Planted trees in Kulu gave 3 to 5 rings, and trees in the Kulu forests an average of 9·6 rings. Bagshawe's measurements in the Peiwar Forests of the Kuram Valley, Afghanistan, gave an average of about 21 rings, which is very slow. These measurements, however, confirm Brandis' classification.

The Working Plans of various Himalayan forests afford important information. Thus N. Hearle's Working Plan of 1888 for the Tehri-Garhwal Leased Forests found the deodar area 45,198 acres, and the number of trees of over 1 ft. in diameter 260,000. The growth by age classes was as follows:—

	V. Class.	IV. Class.	III. Class.	II. Class.	I. Class.		
					A.	B.	C.
Diameter .	0–6 in.	6–12 in.	12–18 in.	18–24 in.	24–30 in.	30–36 in.	36–42 in.
Years .	36	28	26	30	32	35	38

and the outturn—

Girth . . .	6 ft.	7 ft.	8 ft.	9 ft.	These forests may be said to belong to Brandis' 2nd division.
Average age . .	120 years	140 years	165 years	185 years	
No. of sleepers metre gauge .	40	50	70	95	

The same officer's Deoban Working Plan of 1889 for outer range forests (3rd division) gave for growth by age classes—

	V. Class.	IV. Class.	III. Class.	II. Class.	I. Class.	
Diameter .	0-6 in.	6-12 in.	12-18 in.	18-24 in.	over 24 in.	
Years . .	32	15	18	20	85	Age on entry of class.

He also found that the height was, on an average, at 24 in. girth, 99 ft.; at 30 in., 119 ft.; at 36 in., 117 ft.; at 42 in., 129 ft.

The following information is given from Punjab Working Plans :—

	Average rate of growth. Rings per in.	Average no. of years to attain—	Exploitable age adopted. Years.
Kotkhai-Kotgarh	10½	5 ft. . 106	106
Pangi	10	6 ft. . 120	120
Upper Ravi	9	7½ ft. . 135	135
Kulu	7½	6 ft. . 90	90
Simla Municipal Forests . .	10	6 ft. . 120	120

These figures (more might easily be quoted, but it is unnecessary) seem to show that the question of the rate of growth of deodar and the best exploitable age is one which can only be properly discussed in reference to the locality to which it is proposed to apply the results. But it certainly seems as if the exploitable size, usually 6 ft., is a good deal too low for getting the best possible return. It might be better fixed at 8 ft., or even more, even though the rotation may have to be also raised.

As an ornamental tree, there are few trees in the world that can compare with the deodar, even when the most beautiful of those of its own family, like the species of *Araucaria*, *Sequoia*, *Abiés*, *Pseudotsuga* and *Picea* are taken into account. From the Lebanon cedar and the Atlas cedar it differs somewhat in appearance; but even to an expert, in the collections of Europe, it is not always easy to recognize to which of the three varieties a given specimen belongs. Roughly, however, the deodar is distinguished by means of its drooping branches and its longer needles. The deodar is grown as an ornamental tree in the hill stations, and does well when the soil, which should be light, suits it. It does not succeed either at Darjeeling or on the Nilgiris, where there is too much clay. The deodar prefers to grow on gneiss or granite or even on limestone.

Two well-marked varieties are recognizable in the forests, the one with dark green, the other with silvery, foliage. The latter variety, well known in European collections, is found wild in ravines at a comparatively low level. I have seen it in Jaunsar, in the upper Dharagadh, in ravines at from 4-6000 ft., and I believe the variety comes true to seed. Deodar trees are frequently lopped for litter, and retained near villages for that purpose. If the leading shoot is not damaged, the tree grows on well enough, but its timber is naturally not improved by the lopping, though it may cause it to become harder and more oily. When the leading shoot is cut or damaged, the tree shows a great tendency to form others, and frequently several erect shoots with the appearance of young trees may be seen growing up straight from the branches.

These shoots may perhaps afford poles, and part of the original bole may perhaps be utilizable, but, ordinarily speaking, trees of this description are of no value except as seed-bearers. The deodar may almost be said to produce coppice shoots, for, as Brandis remarks, if only a small branch be left to a stump, it will send out shoots and grow well, eventually perhaps forming a new tree.

In close forests, deodar trees flower and seed rather sparsely only; for good seed-bearers we have to look to the old trees on dry ridges where they can get a large amount of sunlight. When the seeds are ripe, the cones break up and the scales fall; the winged seeds are then carried by the wind for a short distance. It may be interesting to record the result of the examination of an average cone by Mr. B. B. Osmaston in October, 1900. He found in the top part 25 scales with 50 bad seeds; in the middle 100 scales with 90 good and 110 bad seeds; in the bottom part 94 scales with 188 bad seeds; the whole cone giving, therefore, 219 scales with 438 seeds, of which 90 were good.

The other varieties are known as the "Cedar of Lebanon" and "Atlas Cedar." Like the Deodar, they are both largely cultivated in Europe. In Great Britain, the Lebanon Cedar was introduced in the year 1683, but the Deodar only in 1822, and the Atlas Cedar in 1843 (G. Nicholson, "Dict. of Gard.," i. 286). The Lebanon Cedar grows chiefly on the mountains of Asia Minor and in Cyprus, its most southerly locality being the celebrated one in the Kedisha valley of Lebanon at about 6500 ft. The Atlas Cedar forms forests on the Atlas range in Algeria at 4–7000 ft.

Deodar timber is, as has already been stated, the chief timber of Northern India. Its most important use is for railway sleepers, of which very large numbers are supplied every year to the various railways of the north. It is also of value for bridge-work, and is employed extensively in building, chiefly for beams and door and window frames, but is rather brittle to work and does not take paint and varnish well. It has also a very strong odour, which, pleasant enough in the open air, is rather unpleasant in a room. The timber is almost all brought out by water; either, as largely in Kashmir and the Punjab, in log; or, as in the Tons and Jumna valleys, in the form of sleepers or scantling. The wood floats very well, and the oil it contains prevents its becoming waterlogged, so that few pieces get irretrievably lost. The logs or sleepers are cut in the forests, far away within the Himalaya, are extracted by means of rough slides or sledge roads or by wire tramways to the rivers, and then floated down with the help of "mullas," men who use inflated skins to help them to move down the rapids. The pieces get much worn against the rocks during the floating, so that they arrive with their edges rounded, but there is no doubt that the floating hardens and seasons the wood more or less. The system of conversion is at present wasteful, as there is little or no means of disposing of the small pieces, slabs, etc., which are left after the sleepers are cut; in time perhaps this may be remedied, and perhaps much of this wood may be used in the hill villages in satisfaction of those rights of building wood which so many of them possess, and which are often exercised wastefully. It is by no means an unusual thing in the Himalaya to see a huge deodar, blue pine, long-leaved pine, spruce, silver fir and even cypress lying rotting. It has been chosen by some village for house-building, often in the exercise of a right, cut down and perhaps one or two 6-foot sections cut out and the rest left. The practice was strongly commented on by Capt. Gerard in his "Account of Koonawur," 1841, p. 68, who says, "It is astonishing 'what a quantity of this fine wood is wasted, even where it is scarce, for the saw is 'unknown; and to get a plank of any size they split a tree into several thick pieces 'with wedges, and then fashion it with an adze, thus losing the greater part of it." Capt. Gerard wrote 60 years ago; my own frequent observations have convinced me that no great improvement has taken place since then, though I am glad to admit that some villagers have learnt the utility of a saw and the saving of labour caused by its employment. I doubt if they ever consider the saving of timber. Deodar wood is very durable, probably, with Cypress, the most durable of Himalayan woods. Stewart mentions the pillars of the Shah Hamaden mosque at Srinagar in Kashmir, which date from 1426 A.D., and are now consequently (1901) 475 years old, as having been quite sound at the time he wrote. It resists wet, also white ants, and apparently does not suffer much from dry rot.

With regard to the weight of Deodar and its transverse strength, the following experiments are available:—

Experiment by whom made.	Year.	Wood whence procured.	No. of experiments.	Size of bar.	Weight.	Value of P.
				ft. in. in.	lbs.	
Col. Maclagan, R.E.	1858	Punjab	1	2 × 1 × 1		554
" "	"	"	4	3 × 1 × 1	23·05	580
" "	"	"	4	3 × 1 × 2		602
" "	"	Garhwal	1	2 × 1 × 1		630
" "	"	"	3	3 × 1 × 1	24·65	637
" "	"	"	4	3 × 1 × 2		550
Major Robertson and Captain Henderson	1856	Punjab	10	various	—	538
Major Cunningham	1854	—	20	2 × 1 × 1	—	656
" "	"	—	12	various	36·70	340
Captain W. Jones	1844	Kumaon	10	—	38	443, unseasoned
			10	—	40	560, seasoned
Rai Kanhya Lal	1876	Punjab: Ravi	4	12 × 6 × 4	38	331
"	"	Ujh	4	"	35	304
"	"	Chenab	4	"	33	346
"	"	Sutlej	4	"	34	215
"	"	Ravi	8	8 × 5 × 3	34	367
"	"	Ujh	8	"	38	387
"	"	Chenab	8	"	34	341
"	"	Sutlej	8	"	33	315
Ganga Ram	"	Chamba	2	12 × 3 × 3	32	351
"	"	"	1	12 × 2·9 × 2·9	34	330
"	"	"	1	12 × 2·8 × 2·8	35	302

NOTE.—The Roorkee experiments gave a mean of 587 as the value of P for Punjab timber, and 592 for Garhwal timber. It has since been proved that these values were too high, and the experiments of Rai Kanhya Lal, who operated on larger pieces, give a mean of 334. The working value of P as taken by the Department Public Works in the Punjab is now 300.

The weight of well-seasoned dry deodar wood of average growth is about 35 lbs. per cubic foot. Branch wood is very much heavier, and is often saturated with resin oil), giving a weight of 48 lbs. per cubic foot (No. H 4470). Dr. Warth's experiments showed that 100 lbs. steam-dry wood gave 0·33 lb. of ash, one-half of which consisted of calcium carbonate. The tree gives only a very small quantity of resin, chiefly from wounds in the bark; but the oil contained in the wood can be extracted by distillation, exactly as is done for the tar of the long-leaved pine. It is a dark brown, strong and unpleasant-smelling fluid, said to be a good antiseptic. It is used to coat the "mussucks," or inflated skins used on the rivers of the Himalaya; also as an outward application to the feet of horses, cattle, and camels; and as a preventive of the bites of the "potú" fly (*Simulium indicum*, Becher), which is so common and so troublesome in Himalayan forests.

So far, the deodar tree has not been found to be much attacked by insect pests, but it is right to notice that the cones are badly damaged by the larvæ of a Pyralid moth, *Euzophera punicæella*, Moore, which eat out nearly all the seeds, even of large apparently healthy cones.

Of fungoid pests, the most serious is the well-known *Polyporus annosus*, Fries (= *Trametes radiciperda*, Hartig), which attacks groups of saplings and kills them. It spreads itself underground from tree to tree through the roots, and in places is likely to be a source of very considerable damage. The leaves of the deodar are also attacked by Uredineous fungi, notably by the *Æcidium Cedri*, Barcl., which forms small yellow spots and causes the leaves to fall off (see "Ind. For." xxv. 431).

		lbs.
H 940.	Chenab Forests (Baden-Powell)	34
H 902.	Siúl Valley, Chumba (Baden-Powell)	32
H 900.	Ravi Forests (Baden-Powell)	36
H 616.	Beas Forests, Kulu (Pengelly)	42
H 617.	Sutlej Forests (Bashahr)	31

		lbs.
H 16.	Cheog Forest, Simla, 7000 ft.	41
H 42.	Mahasu Forest, Simla, 8000 ft.	35
H 3058, 3096.	" " " (Gamble)	42
H 4470.	Deota, Tehri-Garhwal " "	48

Nordlinger's Sections, vol. 11 (*C. Deodara*) (Tab. XVI. 4).

11. PICEA, Link.

The common Spruce (also called Norway Spruce) of Europe is *P. excelsa*, Link. (*Abies excelsa*, DC; Brandis For. Fl. 526), which is, with the Scotch Pine, the most important tree of the northern half of Europe, especially in Norway, Sweden and Russia, yielding the wood known as White Deal. *Picea alba*, Link. is the "White Spruce," and *P. nigra*, Link. the "Black Spruce" of North America.

1. **P. Morinda**, Link.; Fl. Br. Ind. v. 653; Gamble Darj. List 83. *Abies Smithiana*, Forbes; Brandis For. Fl. 525. The Himalayan Spruce. Vern. *Wesha, bajúr*, Afg.; *Kachal, ré, riar, kachan*, Hazara, Kashmir; *Rewari, ban lúdar, sangal, salla, sarei, káuli, roi, rág, ráo, bang re, krok*, Pb. Himalaya; *Tos*, Ravi; *Rau, raiang, re, ryang*, Sutlej; *Rai*, Jaunsar; *Kandre, re, rhái, ráo, khutrau, riálla, rágha, morinda, kail, kilu*, Garhwal, Kumaon; *Sehshing*, Bhutia.

A very large and lofty evergreen tree. *Bark* rough, reddish- or greyish-brown, with very shallow furrows both longitudinal and horizontal, causing small rounded or somewhat quadrangular plates to fall off. *Wood* white, soft to moderately hard; no heartwood, sometimes with a reddish or brown tinge, sometimes (in old wood, seasoned in log) grey. *Annual rings* conspicuously marked, the spring wood soft and spongy. *Medullary rays* fine, very numerous, prominent on a radial section. *Resin-ducts* very scanty or none.

Himalaya, at 7-11,000 ft., extending west to Afghanistan, east to Bhutan; in the Kuram forests at 8-12,000 ft.

The Himalayan spruce is a very fine tree, which, though not perhaps reaching so great a girth as the Deodar, attains very often a greater height. Measurement of large trees made near Mundali in Jaunsar gave from 176 to 215 ft. in height with a girth of 19 to 23 ft. (Gleadow in Ind. For. xxvi. Appx. p. 49). It grows in mixture with silver fir (*Abies Pindrow*), and in such mixed forests the spruce affects the drier ridges, the silver fir the moister ravines. These forests, which are often very extensive in the West Himalaya, cover chiefly the northern and western slopes of the mountains, usually at 7500 to 8500 ft., and a little higher or lower in places. It is also commonly found in mixture with deodar. When grown in close forest, the boles are often without branches to a great height, and the top conical with conspicuously pendant branches. Grown in the open, the branches cover the lower part of the tree as well, but are never of large size. The needles are longer and the cones larger than those of the European spruce. In Sikkim it is not very abundant, and does not appear in the forests of the Darjeeling District.

The treatment suitable for the spruce is still a matter of considerable question. In the more distant forests, this is of not much consequence, as the wood is not in much demand, and whenever deodar is found with it, the spruce has to be made entirely subordinate to its more valuable rival. But in the outer ranges, and especially near cantonments and large towns where a good fuel supply is required, and where spruce planking is in demand, it is important to know how the forests should be treated. The spruce is essentially a light-demander, and requires to be freed from cover as early as possible. In the Kanjatra and Hajawa forests in Jaunsar, under working for the supply of Chakrata, a fairly heavy seed-felling proved a failure, and, after much discussion, the general opinion of those best qualified to decide seems to be that in treating these virgin forests, clear-cutting and artificial regeneration with a well worked-up soil is likely to be the most successful method. Large trees in close forest produce but little seed, and that only at intervals of 3 to 4 years, and liable to be eaten off by birds before it can fall, for birds like the seeds of the spruce as being less resinous and easier

to extract from the cones than those of the other large conifers. The cones are pendulous, and the scales persistent. Then, too, in the spruce forests, the ground vegetation of *Strobilanthes*, small bamboos, raspberries, balsams and other plants is often very rank and very difficult for the seeds to penetrate, so that they fail to reach the ground, or if they do reach it, their resulting seedlings get smothered. Natural reproduction may thus be said to be somewhat doubtful. Artificial reproduction is easy, and is quite successful if done with care, especially if basket-planting is resorted to.

The rate of growth of spruce is fairly fast. Trees at Kalatóp, Dalhousie, measured by Ribbentrop in 1873, gave an average of 11 rings per inch of radius, or 125 years to a girth of 6 ft. This is very nearly the same as the results recorded in the Deoban Preliminary Report of 1875, while the Working Plan of 1889, by N. Hearle, gave, by age classes—

	V. Class.	IV. Class.	III. Class.	II. Class.	I. Class.	
Diameter .	0–6 in.	6–12 in.	12–18 in.	18–24 in.	over 24 in.	
Years .	35	17	24	24	100	Age on entry of class.

the height at 42 in. being 135 ft.

If good *timber* only is required, the exploitable age ought to be more than 100 years, which corresponds to a girth of 6 ft., for a girth of 8 to 10 ft. would perhaps be more suitable; if *fuel* only is required, it is probable that a much earlier exploitable age, say 40 years, corresponding to a girth of a little less than 3 ft., would suit best; if, however, *both* are wanted, possibly 100 years' rotation with a 6-ft. girth is the best average.

The wood of the Himalayan spruce is almost similar to that given by the European spruce. It gives excellent planking for floors, walls and ceilings; it can be used for shingles, and is good for rough purposes like packing-cases, building huts for shepherds, making water-troughs, etc. In Kangra and Kulu it is used for tea-boxes (L. G. Smith). So far it has not been seriously tried, but there is little doubt but that it would be excellent for paper pulp, matches and match-boxes, and perhaps even for sleepers if creosoted. It has one difficulty in that, most of the forests being far from the plains, extraction by floating is necessary, and having little or no resin or oil in the cells, as is the case with deodar, cypress and the pines, it rapidly gets waterlogged and sinks, not to be recovered. The weight of the wood is, on an average, 30 to 32 lbs. per cubic foot. The bark used to be extensively employed by shepherds for roofing their huts, but the practice has been stopped in Government and other forests under conservancy. The leaves and twigs are used for litter and manure. It gives a small quantity of resin, chiefly from between the bark and wood, but not enough to be of any consequence. Dr. Warth found that 100 lbs. of steam-dry wood gave 0·63 lb. of ash, most of which consisted of salts, phosphates or carbonates, of calcium.

The Himalayan spruce is often badly attacked by the same spruce-gall aphis which attacks the European spruce, viz. the *Chermes abietis*, Linn., which forms cone-like excrescences on the twigs. As is well known, this insect in Europe has an alternating generation on the Larch, but so far it is not yet known whether any such alternation exists in India.

It is also the object of the attacks of some *Uredineous* fungi, and notably of one which makes curious tassel-like orange-coloured bunches on the branches. This is *Peridermium incarcerans*, Cooke (= *P. piceæ*, Barcl.). The damage done is not very great. Another species which attacks the leaves is the *Æcidium Thompsoni*, Barcl., but this also is not of much importance.

		lbs.
H 3165.	Dungagalli, Hazara, 7000 ft.	—
H 775.	Kalatóp Forest, Dalhousie, 7000 ft. (W. Pengelly) . . .	31
H 3, 12, 43.	Mahasu Forest, Simla, 8000 ft.	28, 32, 32
H 2896.	Nagkanda, Simla, 9000 ft. (Gamble)	—
H 3032.	Hattu Forest, Simla, 9000 ft. (young tree) (Gamble) . .	39
H 420.	Mohna Block, Deoban Forest, 8000 ft. (Bagshawe) . . .	26

Nordlinger's Sections, vol. 7 (*Abies Smithiana*).

E 965 sent by Dr. Schlich from the Chumbi Valley, Tibet, between Sikkim and

Bhutan, from about 9–10,000 ft., is the wood of a species of *Picea* closely allied to *P. Morinda*, but with shorter needles and smaller cones. It is probably undescribed. The structure of the wood is identical with that of *P. Morinda*.

12. TSUGA, Carrière.

The "Hemlock Spruce" of Canada is *T. canadensis*, Carr. (*Abies canadensis*, Michaux; Brandis For. Fl. 527), a graceful tree, much cultivated in Europe. In Canada and the United States the bark is used for tanning leather.

1. **T. Brunoniana**, Carr.; Fl. Br. Ind. v. 654; Gamble Darj. List 84. *Abies dumosa*, Loudôn; Brandis For. Fl. 527. The Indian Hemlock Spruce. Vern. *Changathasi dhúp*, *thingia*, *thingâni súla*, Nep.; *Tangshing*, Bhutia; *Semadung*, *chemdang*, *nyitkuri*, Lepcha.

A large evergreen tree. *Bark* thick, rough. *Wood* white, soft, with a slight pinkish tinge. *Annual rings* prominent. *Medullary rays* fine, numerous. *Resin-ducts* scanty.

Central and Eastern Himalaya from Kumaon to Bhutan, at 8–10,500 ft.

The Indian Hemlock spruce extends, according to Duthie, as far west as the Káli Valley in Kumaon. Duthie says it forms beautiful forests near Sosa in North-East Kumaon at 9–10,000 ft. (*Gard. Chron.*, March, 1886). In British Sikkim it is found in the Siri Valley, where there are forests, and there it grows mixed with or just below the silver fir (*Abies Webbiana*), and associated with yew, oaks (especially *Quercus pachyphylla*), Rhododendrons (chiefly *R. grande*, *R. Falconeri* and *R. barbatum*) and the Maling bamboo (*Arundinaria racemosa*). It "forms a stately blunt pyramid with 'branches spreading like the cedar, but not so stiff and drooping gracefully on all 'sides" (Hook. Him. Journ. i. 206). Sir J. D. Hooker mentions a tree which had 28 ft. in girth and over 120 ft. in height. The bark is used for roofing, and the wood, which is not of very good quality, for shingles. The growth is rather slow, 11 to 18 rings per inch of radius. The cones are very small, with persistent scales.

		lbs.
E 377.	Phullaloong Ridge, Darjeeling, 10,000 ft. (Johnston) . . .	27
E 968.	Chumbi Valley, Tibet, about 10,000 ft. (Schlich)	29

13. ABIES, Juss.

Two Indian species. The Fl. Br. Ind., following Brandis and also Thomson, have considered them as one; but from personal observation and from the opinion given me by Mons. R. Hickel, who has studied the question on cultivated trees in France, I am so convinced that they are separate species that I propose to follow Royle and make them so here. The "Silver Fir" of Europe is *A. pectinata*, DC; Brandis For. Fl. 528; and several other fine species are in cultivation in Europe, and most noticeably *A. Nordmanniana*, Spach of the Crimea and Caucasus, *A. Pinsapo*, Boiss. of the mountains of Spain and *A. nobilis*, Lindl. of the Western United States of America.

1. **A. Webbiana**, Lindl.; Fl. Br. Ind. v. 654; Brandis For. Fl. 528; Gamble Darj. List 84. Vern. *Chilrow*, *oonum*, N.-W. Him.; *Wúman*, *wúnbu*, Byans; *Gobri sulah*, Nep.; *Dunshing*, Bhutia.

A large evergreen tree. *Bark* greyish-brown, rough. *Wood* white, soft. *Annual rings* conspicuous. *Medullary rays* fine, numerous, irregular. *Resin-ducts* scanty, but distinguishable in the spring wood.

Inner Himalaya, from the Indus to Bhutan at 10–14,000 ft., but rare below 11,000 ft.; Kuram and Hariáb Districts at 8–11,000 ft., usually on ridges (Aitchison).

This silver fir is distinguished from *A. Pindrow* by having quite a different appearance, shorter and thicker leaves white beneath, well-marked rough leaf-cushions on the branchlets, smaller cones with acuminate bracts nearly as long as the scales, and a quite separate zone of vegetation. Brandis tells me he has seen the two growing together, and this is, I believe, the case on the Chor, but my own experience in the valley of the Tons

and on the Chansil Range is that this species commences usually at from 1-2000 ft. above the point where the other disappears. I believe that this species is an Eastern Himalayan one which only extends westwards at high elevations, while *A. Pindrow* is only Western. *A. Webbiana* is said to occur on the Chor, but I have not been there. I never saw it on Kedarkanta. This species has an erect bole with rather thick spreading horizontal branches bearing a flattened leaf-canopy. The leaves are short, white beneath and thick, and the cushions of the fallen leaves very characteristic. It is, with the silver birch (*Betula utilis*), the last tree met with before the treeless snowy wastes begin in the Western Himalaya, and in Sikkim forms forests of considerable extent on the hillsides in more or less exposed places. In the Singalila forests of Sikkim it is gregarious, and in higher levels almost or quite pure; lower down it meets the *Tsuga Brunoniana*, the Yew and various Rhododendrons, and has a dense undergrowth of small bamboo. The rate of growth is only moderately fast, 12 rings being about the average per inch in Sikkim. The bark is used for salt-troughs for sheep in Sikkim, as that of the Yew (and perhaps also that of this silver fir) is used in the Western Himalaya. The cones are erect, purple in colour, and the scales deciduous.

		lbs.
E 359.	Sandukpho, Darjeeling, 11,500 ft. (Johnston)	27
E 2437.	" " " (Gamble)	—
E 964.	Chumbi Valley, Tibet, 10,000 ft. (Schlich)	29

2. **A. Pindrow**, Spach. *A. Webbiana*, var. *Pindrow*, Brandis For. Fl. 528; Fl. Br. Ind. v. 655. Vern. *Palúdar, rewari*, Jhelum; *Búdar, búdar, túng, túng bandar, budlu, drewar*, Kashmir; *Dhúnu, rág, rail, pe, re, salle, sara*, Chamba; *Tos*, Kulu; *Spun, pun, krok, kalrei*, Kunawar; *Bharda, thanera*, Shaji; *Burla, pindrau, pindrai*, Hattu; *Kúdrom*, Matiyana; *Span, krok*, Bashahr; *Burúl, búrra, búldu*, Bhajji; *Kalrai, satrai, chúr*, Kotkai; *Raho, row, chilrow, kilaunta*, Chor; *Morinda*, Jaunsar; *Ragha, rao ragha, ransla, raisalla*, Kumaon.

A lofty evergreen tree. *Bark* smooth and silvery when young; when old greyish-brown, deeply cleft in vertical fissures, thick. *Wood* white, soft. *Annual rings* prominent, the autumn wood rather broad, the spring wood often spongy. *Medullary rays* very fine, very numerous. *Resin-ducts* sometimes rather common in the spring wood, sometimes scarce, moderate-sized.

Outer Himalaya from Chitral to Nepal at 7-9000 ft., occasionally to 10,000 ft.

This, the better known of the two Silver firs in the Western Himalaya, has quite a different appearance to the other. It affects ravines chiefly with a northern or western aspect. It has long green needles and larger cones with very short emarginate bracts. It has, also, nearly smooth silvery branchlets with inconspicuous leaf-cushions. The shape of the tree is very narrowly conical, and the branches, which are small only and short, curve downwards strongly at first, bending up somewhat at the end, so that they open out fan-fashion. It is usually associated with the spruce, *moru* oak, and sometimes the deodar and blue pine. More often its associates are broad-leaved, such as the walnut, moru oak, maples, the bird-cherry and horse-chestnut. At higher levels it joins the kharshu oak. It grows, like the spruce, very tall and of considerable girth, though not quite so large as the deodar. Trees measured in the Mundali Forest in Jaunsar gave heights varying from 188 to 206 ft. and girths of 19 to 26 ft. Kanjilal mentions trees 250 ft. high at Mundáli, but these are not recorded by Gleadow ("Ind. For." xxvi. Appendix, p. 49).

The rate of growth of silver fir is perhaps rather faster than that of spruce when young, slower when old, perhaps about the same on the whole. Mr. Ribbentrop's Kalatóp Working Plan gives an average of 13 rings per inch of radius. Hearle's Deoban Working Plan gives, for age classes—

	V. Class.	IV. Class.	III. Class.	II. Class.	I. Class.	
Diameter .	0-6 in.	6-12 in.	12-18 in.	18-24 in.	over 24 in.	
Years .	39	20	23	27	109	Age on entry of class.

He also gives for the height—at 18 in. diameter 93 ft., at 24 in. 100 ft., at 30 in. 107 ft, at 36 in. 122 ft., at 42 in. 138 ft., and records, as reducing factor for trees under 24 in diameter 0·60, and for those over that size 0·54, which is almost precisely the same a spruce, 0·60 and 0·53.

The Silver fir is essentially a shade-enduring tree: it is wonderful, indeed, how lon it will remain alive and healthy, though making little or no growth, under dense shade and then when the cover is removed shoot up vigorously and well. Its natural repro duction, consequently, is much better than that of spruce, and indeed, except in those old virgin forests of closely grown mixed spruce and silver fir, where, after a seed-felling the ground speedily covers itself with herbaceous vegetation, preventing seeds getting to it, the natural reproduction is usually excellent. Where there is sheep-grazing i fails, of course; though even then, perhaps owing to the protection of a few bushes o a bit of rocky ground, small clumps of seedlings may sometimes be seen. The seed o the silver fir is not sought for by birds, so much as that of the spruce, probably becaus it is more resinous.

The cones are dark purple, erect, and the scales are deciduous. Artificial repro duction is also easy; the seed, though difficult to collect on account of the cones breaking up when ripe, germinates well and the seedlings are hardy. Transplanting is not difficult, though it is better to put the plant into baskets for a year or more before planting out. Seed-sowing at site is not usually successful.

Treated in mixture with other trees like *Karshu* and *Moru* oaks, Silver fir is easy to reproduce, and will probably give the best results. It is only in the vicinity of hil stations and cantonments that its timber is of importance, for, like that of the spruce, it quickly gets waterlogged if floated, and also like that of the spruce, there is little demand for it in the plains, since the railways have not yet adopted the practice of creosoting, and the demand for matchwood and paper-pulp is as yet non-existent. For big timber, an exploitable age corresponding to a girth of 8 to 10 ft. will probably be best; for fuel only a much earlier age would probably be most profitable, say 40 to 50 years.

The wood is used indiscriminately with that of the spruce; if anything, however, its quality is not quite so good. It could be used for sleepers, if creosoted. It is good for planking, tea-boxes, packing-cases, etc., and makes excellent shingles. It gives very little resin. The weight is about 30 lbs. per cubic foot. Capt. Jones' ten experiments in 1844 gave W = 31 lbs., P = 440. The branches are sometimes used for litter.

So far, few, if any, insect or fungoid enemies of the Silver fir have been recorded.

	lbs.
H 934. Hazara, 7000 ft. (Baden-Powell)	29
H 774. Kalatóp Forest, Dalhousie, 7500 ft. (Pengelly)	—
H 2895, 3031. Hattu, Simla, 9000 ft. (Gamble)	—
H 65. Nagkanda, Simla, 9000 ft.	29
H 421. Thona Block, Deoban Forest, 8000 ft. (Bagshawe)	30

Nordlinger's Sections, vol. 7 (*Abies Webbiana*) (Tab. XVI. 5).

14. LARIX, Miller.

The Larch of Europe is *L. europaea*, DC; Brandis For. Fl. 531, found in the Alps of France, Switzerland and Austria and elsewhere in Europe, and now largely planted in Britain. It has been tried in various places in the Himalaya, but not with much success, those at Manáli in Kulu being apparently the most successful, though I can find no record of them since that of Ind. For. vii. 1881, when young trees 4 years old were already 6 ft. high. The Siberian Larch, *L. sibirica*, Led., forms large forests in Russia and Siberia. The American Larch or "Tamarack" of swamp lands in the Northern United States is the *L. americana*, Michx.

1. **L. Griffithii**, Hook. f. and Th. in Ill. Him. Pl. t. 21; Fl. Br. Ind. v. 655; Brandis For. Fl. 531; Gamble Darj. List 84. The Sikkim Larch. Vern. *Boargasella*, Nep.; *Sah*, *saar*, Lepcha.

A deciduous tree. *Bark*, reddish-brown, ½ in. thick. *Wood* soft to moderately hard: sapwood white; heartwood red. *Annual rings* very distinct. *Medullary rays* fine, numerous, prominent on a radial section. *Resin-ducts* scanty, large.

Eastern Himalaya, in Eastern Nepal, Sikkim and Bhutan, at 8–12,000 ft.

The Sikkim Larch is not found in the Darjeeling Forests, but only in the inner ranges. Sir J. D. Hooker in Him. Journ. ii. 44 says the wood is white, and that he never saw it red, as the Chumbi specimen certainly is. The Chumbi specimen was well authenticated by excellent fruiting specimens, having cones considerably larger than those of the European Larch and with more conspicuous bracts, which, with the scales, are persistent. Growth slow, about 21 rings per inch of radius. The wood is durable and is exported from Sikkim into Tibet.

		lbs.
E 969.	Chumbi Valley, Tibet, about 10,000 ft. (Schlich)	32

Order CIX. CYCADACEÆ.

A most interesting Order of plants, but one of very small importance in Forest economy. In appearance, the Indian Cycads resemble palms or tree-ferns; they have usually a thick woody or more or less spongy stem which is not, or very little, branched. The leaves are large and pinnate. They come near to the vascular cryptogams and especially to the *Marattiaceæ* tribe of ferns: in former periods of the world's history they were of great importance and appeared among the first of phanerogamic plants.

1. CYCAS, Linn.

Five species. *C. Rumphii*, Miq.; Fl. Br. Ind. v. 657.; Bedd. Fl. Sylv. ccxxvii.; Kurz For. Fl. ii. 502; Trimen Fl. Ceyl. iv. 122 (*C. circinalis*, Roxb. Fl. Ind. iii. 744); Vern. *Môndaing*, Burm.; *Maha-madu*, Cingh., has a thick cylindrical palm-like scarred trunk, occasionally branched and reaching 20 to 25 ft. in height, with a girth of 3 to 4 ft. It is found in the beach forests of South Tenasserim and the Andaman Islands, and is often cultivated in gardens. Prain says that it is also found in the Coco Islands, and there attains a height of 50 ft., with a girth of 5 ft. "The wood 'yields a good quantity of sago or starch, the seeds are in Ceylon made into flour. 'Exudes a good sort of resin, which is applied to malignant ulcers" (Kurz). *C. siamensis*, Miq.; Fl. Br. Ind. v. 657; Kurz For. Fl. ii. 503; Vern. *Môndaing*, Burm., is an evergreen shrub or small palm-like tree found in the Eng and dry forests of Prome in Burma and in the Shan Hills. It gives a whitish gum. *C. revoluta*, Thunb. is a Japanese species often grown in Indian gardens.

1. C. circinalis, Linn.; Fl. Br. Ind. v. 656; Bedd. Fl. Sylv. ccxxvii.; Trimen Fl. Ceyl. iv. 121. *C. sphærica*, Roxb. Fl. Ind. iii. 747. Vern. *Orasmaro, orguna, oruna, rengua*, Uriya; *Pér ita*, Tel.; *Madu*, Cingh.

An evergreen palm-like tree. *Bark* brown, smooth below, tessellated above in small diamond-shaped scars. *Wood* soft, yellowish, consisting of alternate layers of woody and bast tissue, the woody layers about twice as broad as the bast ones, and all concentric though rather irregularly anastomozing. The woody layers consist, like the wood of *Coniferæ*, of tracheides and have no pores. The tracheides have many small not bordered pits. *Medullary rays* fine, numerous, regular.

South India, on both sides of the Peninsula, on the east extending north to Orissa; moist region of Ceylon up to 1500 ft.

This Cycas is found in the undergrowth of the forests, and may reach a height of 15 ft. It is often branched. The seeds give a kind of flour, and are hollowed out and used by the Khonds as snuff-boxes. The stems give a clear gum.

		lbs.
C 3782.	Ganjam Forests (Gamble)	—
D 4279.	Mogilipenta, Cuddapah (Gamble)	37

2. C. pectinata, Griff.; Fl. Br. Ind. v. 657; Kurz For. Fl. ii. 503; Gamble Darj. List 84. Vern. *Thakal*, Nep.

A small evergreen palm-like tree. *Bark* brown, in horizontal

folds with diagonal clefts making diamond-shaped bosses. *Wood* yellowish-white, in alternate more or less concentric but anastomozing rings of wood tissue and bast tissue. *Medullary rays* fine, numerous.

Eastern sub-Himalayan tract from Nepal eastwards, ascending the hot valleys; Khasia Hills, Assam, Chittagong Hills; Eng and pine forests of Martaban and Tenasserim.

In the Darjeeling Terai, this Cycas is common in the outer Sál forests, like the Sath Bhaia and Tehsilpur Jhars, also in the Tista and Great Rangít valleys and in other valleys of the lower hills. It gives a coarse kind of sago, which, with the fruit, is eaten by Lepchas.

		lbs.
E 877.	Balasun Forest, Darjeeling, 1000 ft. (Gamble)	—
E 2439.	Chenga Forest " " "	54

3. **C. Beddomei,** Dyer; Fl. Br. Ind. v. 658. C. *revoluta*, Bedd. Fl. Sylv. ccxxvii. Vern. *Pér ita*, Teb.

A low short-stemmed treelet. Bark brown, exfoliating in rectangular scales showing a yellow under-surface. *Wood* yellowish-white, in alternate concentric or anastomozing layers of woody and bast tissue, the latter layers rather narrow. *Medullary rays* fine, numerous.

Hills of the Ceded Districts, especially Cuddapah.

D 4280. Mogilipenta, Cuddapah (Gamble).

CLASS III. MONOCOTYLEDONS.

Orders 110 to 114.

The wood of Monocotyledonous trees differs considerably from that of Dicotyledons and Gymnosperms. In a Monocotyledonous stem the wood is in distinct fibro-vascular bundles in no regular arrangement, and more or less separated from each other by the cellular tissue or parenchyma. Though the arrangement of the bundles is irregular, it may roughly be noted that those of the interior are larger and more complex, the outer less so, the outermost smaller and simpler still, and they all are connected with leaves—that is to say, they pass from the leaf-stalk downwards in a curved fashion, first inwards and then outwards, finally joining or passing parallel to each other down the outer cylinders. In section, a fibro-vascular bundle in a woody Monocotyledon shows usually a few large pores which are large pitted vessels; a few smaller, which may be spiral or annular vessels; on the outer side and between the pores a small mass of bast cells (phloem), the whole surrounded by a thick-walled fibro-vasal ring. There is no regular *bark*, but sometimes there is a thin cylinder of tissue resembling it. When once developed, the stem usually increases no more in thickness, so that a young palm or bamboo, for instance, has from the first the greatest thickness which it will attain during life.

The chief woody plants of the Monocotyledons are the Palms and Bamboos; in the former, the wood is continuous throughout the cylinder; in the latter, the central portion is usually hollow, so that the wood is found in a ring.

ORDER CX. SCITAMINEÆ.

The Ginger Family. The plants of this Order are scarcely woody, though some of the Tribe MUSEÆ attain a large size.

There are four Tribes. Tribe 1. ZINGIBEREÆ contains the ginger, cardamom and turmeric, all well-known Indian cultivated plants. *Alpinia nutans*, Roscoe; Fl. Br. Ind. vi. 256, is a large gregarious species of the swamps of the Terai, growing to a height of 10 to 15 ft., and important as fodder for elephants. Tribe 2. MARANTEÆ contains the arrowroot, also the *Clinogyne dichotoma*, Salisb.; Fl. Br. Ind. vi. 258, the plant from whose stems the beautiful *Sitalpati* mats are made. Tribe 3. CANNEÆ contains the well-known garden *Canna indica*, Linn. Tribe 4. MUSEÆ contains the "plantains," of which there are six species. *M. superba*, Roxb.; Fl. Br. Ind. vi. 261, is a fine species of the Bombay Ghâts. *M. sapientum*, Linn. is the common "plantain" or "banana," which is wild in many of the damper forests in India, and is everywhere cultivated for its fruit. Though quite herbaceous, it reaches the proportions of a small tree with very large leaves, 4 to 5 ft. long and 2 ft. broad. *M. textilis*, Née, of the Philippine Islands, is sometimes cultivated in India; it gives the valuable Manila hemp. *Ravenala madagascariensis*, Sonn.; Fl. Br. Ind. vi. 198; Kurz For. Fl. ii. 504, is the "Traveller's tree" of Madagascar, an evergreen palm-like tree with plantain-like distichous leaves and a more or less woody trunk 20 to 30 ft. high. It is cultivated in gardens in many places in India where the climate is moist and warm enough for it.

In the Natural Order HÆMODORACEÆ comes *Sanseviera Roxburghiana*, Schult.; Fl. Br. Ind. vi. 271, which is found in many forests in South India and collected for its valuable fibre.

The Natural Order AMARYLLIDEÆ contains the so-called American Aloes, chief of

which is *Agave americana,* Linn.; Fl. Br. Ind. vi. 277, so conspicuous as a hedge plant especially along Indian railways.

ORDER CXI. LILIACEÆ.

In India four genera contain more or less woody plants—Smilax, Asparagus, Dracæna, Cordyline. The rest are herbaceous, some of them, like the lilies, being conspicuous forest flowering plants. *Lilium giganteum,* Wall.; Fl. Br. Ind. vi. 349, is a tall species with white flowers reaching 6 to 12 ft. in height in damp valleys of the Himalaya at about 7–9000 ft. *L. polyphyllum,* Don is a common species in the forests of the West Himalaya, and has recurved petals, dull white striped with purple. *L. neilgherrense,* Wight, with large white flowers, is conspicuous in open shrubby banks in the hills of South India. *Gloriosa superba,* Linn.; Fl. Br. Ind. vi. 358, is a handsome climbing plant with splendid golden and scarlet flowers, found in the outskirts of forests in most parts of India.

1. SMILAX, Linn.

Several species are small erect shrubby plants of the Himalayan forests, noticeable among which are *S. vaginata,* Dcne. of the underwood of the oak, fir and deodar forests of the West Himalaya; and *S. rigida,* Wall. of the forests of Sikkim. Among climbing species, besides *S. prolifera,* Roxb., *S. aspera,* Linn., is a woody climber of the Himalaya, often with variegated leaves; and *S. Wightii,* A. DC is a large climber common in the sholas of the Nilgiri Hills at 4–6000 ft.

The wood consists of cellular tissue, with rather large but distant fibro-vascular bundles, each with two or three large pores and a few smaller ones.

1. **S. prolifera,** Roxb. Fl. Ind. iii. 795; Fl. Br. Ind. vi. 312; Trimen Fl. Ceyl. iv. 283. Vern. *Kumari, dahni, maskanti,* Behar; *Seinnabaw, seintabaw,* Burm.; *Mahdkabarasa,* Cingh.

A thorny climber. Outer surface smooth, furrowed, marked by remains of fallen leaves, jointed. *Wood* like that of canes, consisting of soft cellular tissue, in which are embedded irregularly fibro-vascular bundles. These have usually two large pores, with a third which is often subdivided.

Deciduous forests in most parts of India, common in those of Sál.

C 3763. Ganjam forests (Gamble).

2. ASPARAGUS, Linn. Seventeen species of *Asparagus* are described in Fl. Br. Ind., all erect or climbing usually spinescent shrubs. The largest and most common is *A. racemosus,* Willd.; Fl. Br. Ind. vi. 316, which often covers the bushes and shrubs on the outskirts of the forests, almost all over India, with a sheet of white fragrant flowers. The shoots of several species are edible, resembling those of the cultivated Asparagus in flavour.

3. DRACÆNA, Linn. Eight species are described in the Fl. Br. Ind. *D. angustifolia,* Roxb. Fl. Ind. ii. 155; Fl. Br. Ind. vi. 327; Kurz For. Fl. ii. 543 (*D. ensifolia,* Wall.; Kurz *l.c.*); Vern. *Kunlinnet,* Burm., is an evergreen shrub or small tree of the Khasia and Naga Hills, Sylhet, Burma and the Andaman Islands. *D. spicata,* Roxb. Fl. Ind. ii. 157; Fl. Br. Ind. vi. 328; Kurz For. Fl. ii. 545, is a small evergreen treelet of Sylhet, Chittagong and the Andamans. The rest are quite small. The celebrated "Dragon-free" of the Canary Islands, which grows to a great age and very large size, is *D. Draco,* Linn. The most especially celebrated specimen was that of Orotava near Teneriffe, destroyed by a storm in 1867, when its trunk had a circumference of 78 ft., and its height was 75 ft. (Kew Museum Cat.).

The stem-wood of *Dracæna,* in fact of most *Liliaceæ,* differs from that of the larger Monocotyledonous Orders such as *Palmeæ* and *Gramineæ,* by its capability for increasing in diameter and by having a distinct outer bark.

4. CORDYLINE, Commers. *C. terminalis*, Kunth; Fl. Br. Ind. vi. 331; Kurz For. Fl. ii. 546 (*Dracæna terminalis*, Roxb. Fl. Ind. ii. 156), is an evergreen erect glabrous shrub of Bengal, Assam and Burma, with large leaves, frequently cultivated in gardens.

ORDER CXII. PALMEÆ.

A most important Order of plants, containing some of what have been called the princes of the vegetable kingdom. Not only are the palms among the most beautiful of plants, but they contain species which afford some of the most valuable of economic products, for examples of which I need only point to the coconut, date, oil-palm, sago-palm, and various others giving foodstuffs, wax, flour, gums, fibres and building timber. In Indian *Forest* economy, only a few are of great importance, *e.g.* the palmyra, which forms valuable gregarious forests in places, as does the wild date also; but there are other species occasionally found in the forests which have a special importance, and among these the most noticeable are the *Caryotæ*, *Arenga*, *Nipa*, species of *Phœnix* and the rattan canes. Some species are found only in cultivation, artificially grown in forests, such as the *Areca* palm and coconut.

Many exotic species are to be found in cultivation in India. Species of *Chamærops* and *Livistona* are commonly cultivated in gardens in the north, while in the Royal Botanic Gardens of Calcutta and Peradeniya, the public gardens of Madras, Bombay, Rangoon and elsewhere, and in many private gardens, numbers of other introduced species may be seen. The collections of the two Botanic Gardens mentioned, those at Penang and Singapore, and that of the Dutch colonial garden at Buitenzorg in Java, are justly celebrated all over the world for the splendid series of palms that has been got together. In these and in various other collections, the most noticeable species is perhaps the *Oreodoxa regia*, H. B. and K., of Cuba and Central America, distinguished by the somewhat inflated base and upper portion of its trunk. It is generally planted in avenues, and has a fine effect, the grey symmetrical stems recalling the columns of an ancient Egyptian temple. The 24 Indian genera of palms belong to six Tribes, viz.—

Tribe I. Areceæ	Areca, Pinanga, Loxococcus, Oncosperma, Bentinckia, Wallichia, Didymosperma, Arenga, Caryota, Nipa.
„ II. Phœniceæ	Phœnix.
„ III. Corypheæ	Corypha, Nannorhops, Licuala, Livistona, Trachycarpus.
„ IV. Lepidocaryeæ	Calamus, Dæmonorops, Zalacca, Korthalsia, Plectocomia, Plectocomiopsis.
„ V. Borasseæ	Borassus.
„ VI. Cocoineæ	Cocos.

The wood and bark are not distinct, but the stem generally consists of an inner softer and an outer harder portion. The stem consists of a large number of scattered fibro-vascular bundles, embedded in soft cellular tissue. On a horizontal section the vascular bundles appear most numerous near the circumference of the stem, where they are small, very hard, and often nearly confluent, so as to form a hard rind. In the centre of the stem, the bundles are less numerous and generally not so hard as near the circumference. Consequently, the central portion of the stem is chiefly composed of cellular tissue which often decays, so that the centre of old palms is frequently hollow, with a few isolated fibres.

On a vertical section the fibro-vascular bundles appear like long wavy lines, which do not run parallel to each other. On a radial section the vascular bundles cross each other, and they can be traced from the base of the leaf, where they terminate, bending inwards to the centre of the stem and then outwards again towards the circumference.

The structure of each bundle is different in its upper and lower parts. In its upper part it contains, firstly, vessels varying in size, which on a horizontal section appear as pores; secondly, elongated or polygonous cells, generally forming a mass of softer tissue immediately surrounding the vessels; thirdly, a mass of long, thick-walled fibres, of which the hard horny portion of the bundle is composed. In the lower part, the bundle is composed almost entirely of fibres without any vessels or cells.

A horizontal section shows the bundles near the circumference in their lower part; these therefore only consist of fibre, while towards the centre the upper part of the bundles is cut through and shows fibres, vessels and cells. It must not be forgotten that on a cross-section the upper portion of the bundles may be cut through near the circumference where they enter the leaf-stalk, but these are cut through obliquely, are easily recognized, and there are few of them.

TRIBE I. ARECEÆ.

Actinorhytis Calapparia, Wendl. and H. Drude; Talbot Bomb. List 201 (*Areca cocoides*, Griff.); Vern. *Ram supári*, Kan., is a Malay palm, often planted in the areca-nut groves of N. Kanara.

1. ARECA, Linn.

Four species. *A. concinna*, Thw.; Fl. Br. Ind. vi. 406; Trimen Fl. Ceyl. iv. 322; Vern. *Lénteri*, Cingh., is a small erect species reaching about 8 to 12 ft. in height and 1½ to 2 in. in diameter, endemic in the moist low country of Ceylon. *A. triandra*, Roxb. Fl. Ind. iii. 617; Fl. Br. Ind. vi. 406; Kurz For. Fl. ii. 537; Vern. *Bangúa, ramgúa, rani supari*, Beng.; *Tawkunthi*, Burm.; *Abaradah*, And., is a small erect species, reaching 12 to 25 ft. in height with 1 to 1½ in. in diameter, found in the undergrowth of tropical forests in Chittagong, Burma and the Andaman Islands. *A. nagensis*, Griff., is a rather tall species of the Naga Hills of Assam, but little known.

1. **A. Catechu**, Linn.; Fl. Br. Ind. vi. 405; Roxb. Fl. Ind. iii. 615; Brandis For. Fl. 551; Kurz For. Fl. ii. 536; Gamble Darj. List 84; Talbot Bomb. List 200; Hook. f. in Trimen Fl. Ceyl. iv. 321. The Areca-nut or Betel palm. Vern. *Supari*, Hind.; *Gua*, Beng.; *Pung*, Mar.; *Poka, oka, vaka*, Tel.; *Camugu, paku, kamukai*, Tam.; *Adike*, Kan.; *Adaka, kamugu*, Mal.; *Puwak*, Cingh.; *Kunthi, kúnbin*, Burm.; *Ah-búd-dah, ah-pur-rud-dah*, And.; *Pinang*, Malay.

A tall tree. *Stem* slender, cylindrical, grey, annulate, the inner part generally hollow. *Wood* brownish-grey. Vascular bundles large, brown, forming a hard rind on the outside of the stem, each with a heart-shaped horny part and one pore in the sinus.

Cultivated throughout tropical India; original country unknown.

The Areca-nut palm is grown in large groves in all the moist hot regions of India, especially in Malabar and Kanara, in Burma, in Ceylon, in Bengal and Assam, and at the foot of the Nilgiri and other hills of South India. It reaches a height of 40 to 100 ft., and a diameter of 6 in. to 1 ft., the stem being cylindrical with regular rings, the scars of fallen leaf-sheaths. It is a very beautiful palm, and very ornamental in gardens. In Malabar the black pepper vines are grown on the stems.

A. Mendis gives the weight per cubic foot at 57 lbs. The wood is used for furniture-pins, bows, spear-handles, and for scaffolding-poles in Ceylon. The sheaths of the leaves are used to wrap up articles and as paper to write upon; the seeds are used in turning for necklaces, the knobs of walking-sticks and other small articles,

on account of the reticulated appearance formed by the ruminate lines in the albumen of the nut. These nuts are the well-known betel nut, so universally chewed by natives of India, especially in Bengal and Burma. Most villages in Bengal, Burma and South India have their few betel trees. On the Bombay coast, the Areca palms are often badly damaged by a scale insect, *Chionaspis aspidistræ*, Sign., which largely reduces the outturn of fruit. The nuts are sometimes badly damaged, when stored for trade purposes, by the beetle *Aræocerus fasciculatus*, Degeer ("Ind. Mus. Notes," iv. 125).

	lbs.
E 419. Sundarbans (Richardson)	—
W 769. South Kanara (Cherry)	—
No. 73, Ceylon Collection, old; No. 118, new (A. Mendis)	57

2. PINANGA, Bl.

About eight species, small erect palms like the smaller species of *Areca*, and of little importance. *P. hexasticha*, Scheff.; Fl. Br. Ind. vi. 406; Kurz For. Fl. ii. 539, grows to a height of from 25 to 30 ft. in marshy places at the southern end of the Pegu Yoma. *P. Kuhlii*, Bl.; Fl. Br. Ind. vi. 409 (*P. costata*, Bl.; Kurz For. Fl. ii. 538), is a soboliferous species of the South Andaman Island. *P. Dicksonii*, Bl.; Fl. Br. Ind. vi. 409 (*Areca Dicksonii*, Roxb. Fl. Ind. iii. 616), is a small species, 16 to 18 ft. in height, found in the forests of the Western Ghâts. Dr. Dickson reported that the fruits were used for chewing as a substitute for those of *A. Catechu* (Griff.). *P. Griffithii*, Becc. and *P. Hookeriana*, Becc. are found in the Khasia Hills. *P. Manii*, Becc.; Fl. Br. Ind. vi. 409, is a comparatively large species, reaching 50 ft. in height and 5 to 6 in. in diameter in the Andaman and Nicobar Islands.

1. **P. gracilis**, Bl.; Fl. Br. Ind. vi. 407; Kurz For. Fl. ii. 538; Gamble Darj. List 85. *Areca gracilis*, Roxb. Fl. Ind. iii. 619. Vern. *Gua supari, ramgua*, Beng.; *Khur, kar*, Lepcha; *Ranga*, Ass.; *Tawkunthi*, Burm.

A slender palm. Stems brown, jointed, with closely packed fibro-vascular bundles outside, the inside becoming hollow when dry.

Lower Himalaya of Sikkim and Bhutan at 2–3000 ft.; Assam, Khasia Hills and Chittagong; tropical forests of Burma, and north to the Kachin Hills.

This little species is common in the Darjeeling Hills. In Assam its leaves are used in roofing native huts.

E 3425. Dalingkot, Darjeeling, 1500 ft. (Gamble).

3. LOXOCOCCUS, Wendl. and Drude. *L. rupicola*, Wendl. and Dr.; Fl. Br. Ind. vi. 413; Trimen Fl. Ceyl. iv. 322; Vern. *Dotalu*, Cingh., is an erect but soboliferous palm, rather common on rocks and cliffs in the moist region of Ceylon, at 1–5000 ft. The seed is used to masticate, like the Betel-nut. It reaches 30 to 40 ft. in height, with a diameter of 1½ in.

4. ONCOSPERMA, Bl. *O. fasciculatum*, Thw.; Fl. Br. Ind. vi. 415; Trimen Fl. Ceyl. iv. 323; Vern. *Katu-kitul*, Cingh., is an endemic Ceylon palm, growing on steep hillsides in the moist region. The stems reach 50 to 60 ft. in height, with 5 to 6 in. in diameter, and are copiously armed with long flexible black spines. The fruit resembles very large black currants.

5. BENTINCKIA, Berry.

B. nicobarica, Becc.; Fl. Br. Ind. vi. 418, is a tall palm of the Nicobar Islands, with a trunk 60 to 70 ft. high and 9 in. in diameter.

1. **B. Coddapanna**, Berry; Fl. Br. Ind. vi. 418; Roxb. Fl. Ind. iii. 621. Vern. *Conda-pana*, Tam.

An erect palm, 6 to 7 in. in diameter, 20 ft. high. *Stem* grey,

striate longitudinally. *Wood* grey with large fibro-vascular bundles, the horny part grey, each with a pore on the inner side.

Hills of Travancore and Tinnevelly.

W 4301. Tinnevelly (Brasier).

6. WALLICHIA, Roxb.

Three species. *W. densiflora*, Mart.; Fl. Br. Ind. vi. 419; Brandis For. Fl. 549; Kurz For. Fl. ii. 532; Gamble Darj. List 85; Vern. *Kala aunsa, gor aunsa*, Kumaon; *Ooh, uh*, Lepcha; *Takoru*, Nep.; *Zanaung*, Burm., is a small stemless palm, common in the Outer Himalaya from Kumaon eastwards up to 4000 ft., in Eastern Bengal and Chittagong. In Kumaon the leaves are used for thatching, and in Darjeeling they are employed as pony-fodder, while the midrib of the leaves makes combs for the Nepalese settlers. *W. caryotoides*, Roxb.; Fl. Br. Ind. vi. 419; Brandis For. Fl. 550; Kurz For. Fl. ii. 532 (*Wrightea caryotoides*, Roxb. Fl. Ind. iii. 621); Vern. *Chilpatta, belpatta*, Chittagong; *Mochooma*, Magh; *Zanaung*, Burm., is a small palm of Chittagong and Burma.

1. **W. disticha**, T. And.; Fl. Br. Ind. vi. 419; Gamble Darj. List 85. *W. Yomæ*, Kurz For. Fl. ii. 533. Vern. *Katong*, Lepcha; *Zanaung*, Burm.

An erect palm. *Stem* covered with bases of fallen leaves, shaggy with fibre. *Wood* soft, when dry hollow in the centre, fibro-vascular bundles dark brown or black.

Outer hills of Darjeeling District and perhaps eastwards up to 2000 ft.; Kachin Hills and upper mixed forests of the Pegu Yoma in Burma.

A very interesting and curious palm with distichous or somewhat spiral leaves. It grows to a height of 15 to 20 ft., with a diameter of 6 to 12 in., and has its large grey leaves joined at the base by a network of dark fibres. The Lepchas fell it to get the pith, which they eat, so that the tree may eventually get scarce in Sikkim. T. Anderson says that the berries, and perhaps the leaves, irritate the skin, but I never found it so. It prefers to grow on very steep rocky places in full glare of sunlight.

E 878, 2460. Sivoke Hills, Darjeeling (Gamble).

7. DIDYMOSPERMA, Wendl. and Drude. Two species. *D. nana*, Wendl. and Drude; Fl. Br. Ind. vi. 420, and *D. gracilis*, Hook. f., are dwarf palms of Assam and the Khasia Hills.

8. ARENGA, Labill. Two species.

A. saccharifera, Labill.; Fl. Br. Ind. vi. 421; Brandis For. Fl. 550; Kurz For. Fl. ii. 533 (*Saguerus Rumphii*, Roxb. Fl. Ind. iii. 626); Vern. *Taung-ôn*, Burm.; *Eju*, Malay, is the common Malayan Sago palm, very commonly cultivated in India, and wild in the forests of Burma and Assam. The heart of the stem contains large quantities of sago, and the cut flower-stalks yield a sugary sap, which is made into sugar and palm wine. The horsehair-like fibre found at the base of the petioles is similar in its uses to coconut fibre and is valuable for cordage. The palm dies after ripening its whole crop of fruit, and the stems, which speedily become hollow, are then useful for troughs and water-channels, lasting well underground. Roxburgh was so impressed with its general utility that he recommended its being largely cultivated in India. He records that one tree gave about 150 lbs. of good sago meal. It reaches a height of 20 to 40 ft., with a diameter of 1 to 2 ft., and retains its leaves for long, so that it is leaf-bearing almost from the base up. The leaves are very long, sometimes 20 to 28 ft., and the Fl. Br. Ind. says that there are often up to 115 leaflets on each side of 3 to 5 ft. in length. They are joined together by shaggy fibres. *A. Wightii*, Griff.; Fl. Br. Ind. vi. 422; Talbot Bomb. List 201, is a stemless or short-stemmed long-leaved palm of the Ghâts of North Kanara, extending to Coimbatore and the Nilgiri Hills at 1500–3000 ft. It grows chiefly in forest undergrowth in ravines, and is very local. I have found it in the Coonoor Valley, and Talbot says it is common near the falls of Gairsoppa.

9. CARYOTA, Linn.

Three species. *C. obtusa*, Griff.; Fl. Br. Ind. vi. 422; Vern. *Bura suwat*, Ass., is a species of the Mishmi Hills in Assam at 3–4000 ft. closely resembling *C. urens*, but with more obtuse leaflets. *C. mitis*, Lour.; Fl. Br. Ind. vi. 423 (*C. sobolifera*, Wall.; Kurz For. Fl. ii. 530); Vern. *Minbaw*, Burm.; *Baratahdah*, And., is a soboliferous species of the tropical forests of Arracan, Martaban, Tenasserim and the Andaman Islands. Prain says it forms dense thickets in the Coco Islands, and Mr. Homfray says it is called the "Sago Palm" in the Andamans (B 1045, Andaman Islands).

1. **C. urens,** Linn.; Fl. Br. Ind. vi. 422; Roxb. Fl. Ind. iii. 625; Brandis For. Fl. 550; Kurz For. Fl. ii. 530; Gamble Darj. List 85; Talbot Bomb. List 201; Trimen Fl. Ceyl. iv. 324. Vern. *Rungbong, simong*, Lepcha; *Tamadong*, Bhutia; *Bara flawar*, Ass.; *Salopa*, Uriya; *Solopo, sarta*, Khond; *Jiluga*, Reddi; *Mhár, mardi, mari, jirúgú*, Tel.; *Conda-panna, erim-panna, utali-panna, tippilipana*, Tam.; *Bhyni, beina, baini, bugani, bagni*, Kan.; *Berli*, Mar.; *Shundra pana, erimpana, chúndapana, olathi*, Mal.; *Kitúl, nepora*, Cingh.; *Illyamban*, Magh; *Minbaw*, Burm.

A fine palm. *Stem* smooth, cylindrical, annulate, grey. *Wood* very hard in outside portion, soft within, the outside brown with close black streaks caused by the horny part of the fibro-vascular bundles. This is black, somewhat quadrangular or triangular in section, with a large pore at the base inside.

Lower Himalaya from Nepal eastwards up to 4–5000 ft.; Assam, Eastern Bengal and Chittagong; upper mixed forests of Upper Burma and the Pegu Yoma; Orissa, the Circars and shady valleys in the eastern forests of the Deccan; Western Coast from the Konkan southwards; low country of Ceylon: much planted in gardens.

This splendid palm is remarkable for its much-cut leaves and wedge-shaped leaflets. The leaves are often 18 to 20 ft. long and 10 to 12 ft. broad and the trunk rises to 30 to 40 ft., with a diameter of 1 ft. A. W. Higgens found one in the Palkonda Hills, Cuddapah, which was nearly 50 ft. high and 6 ft. in girth. In the Darjeeling Hills it is rarely of large size, as it is much cut for food by the Lepchas. The same is the case in the hills of Orissa and the Circars, but near villages it is protected by Khonds, Sauras, and other tribes on account of its toddy. In that region its leaves are the chief fodder for elephants. The wood is strong and durable; it is used for agricultural purposes, water conduits and buckets; and it is also employed for plough-shafts and for rafters in house-building. The leaves give the "*Kitúl*" fibre, which is very strong, and is made into ropes, brushes, brooms, baskets and other articles; the fibre from the sheathing petioles and the peduncle is made into ropes and fishing-lines, which are very strong. The interior of the stem is filled with a sago-like starch which is made into bread or boiled into gruel. Seemann says it is good and very nutritious. From the cut spadix large quantities of toddy are obtained, which is either fermented or boiled down into sugar. For an account of the tapping of *Caryota* in Travancore, see A. M. Sawyer in Ind. For. xxi. 134. With regard to the length of life of the tree, Seemann says ("Popular History of Palms," p. 135), "The *Caryotas* flower only once during their course of existence. The first spadix 'appears at the top of the tree; as soon as that has done flowering, others (latent buds) 'issuing from the axils, or former axils, of the leaves, make their appearance; this 'process, being of a downward tendency, is repeated until the last spadix, which may 'be looked upon as the death-knell of the plant, shows itself at the foot of the trunk, 'proclaiming that the hour of departure from life is at hand."

	lbs.
E 2459. Chawa Jhora, Sivoke, Darjeeling (Gamble)	45
D 4278. Mogilipenta, Cuddapah (Gamble)	54
No. 44, Ceylon Collection (old), 74 (new) (A. Mendis)	71

10. NIPA, Wurmb. *N. fruticans*, Wurmb.; Fl. Br. Ind. vi. 424; Roxb. Fl. Ind. iii. 650; Kurz For. Fl. ii. 541; Trimen Fl. Ceyl. iv. 325; Vern. *Gúlga, gabna, golphal* (fruit), *golpatta* (leaves), Beng.; *Dani*, Burm.; *Poothadah*, And.; *Ginpol*, Cingh., is a large gregarious soboliferous palm with branched rootstock and pinnate leaves, often 23 to 30 ft. long. It is found in the river estuaries and tidal forests

of the Sundarbans, Chittagong, Burma and the Andamans; also, but rarely, in Ceylon, but not in the Peninsula. The leaves are very largely used for thatching and at the Straits for covering cigarettes; toddy is obtained from the spathe; and the young fruit is edible. The old fruits are large, the interior being hard like ivory, but transparent; they are carried to sea and floated great distances. In "Him. Journ." Hooker draws attention to the frequency with which very similar fruits are found in the Tertiary strata at the mouth of the Thames, and points out how they must have floated there as the fruits of *Nipa* do now to distant shores. The leaf-stalks are used to help to float Sundri logs in the Sundarbans, also as fishing floats. The trade in Golpatta leaves in the Sundarbans is considerable; it amounts yearly to about 135,000 tons, valued at nearly Rs.60,000.

TRIBE II. PHŒNICEÆ.

11. PHŒNIX, Linn.

There are eight species of wild date palm in India, and the cultivated date, *P. dactylifera*, Linn.; Roxb. Fl. Ind. iii. 786; Brandis For. Fl. 552; Vern. *Khajúr*, is now largely planted in various parts of India. When Brandis' For. Flora was published, it was only mentioned that it was cultivated in the Punjab and Sind; but of recent years, owing to the Government having taken the matter up strongly, plantations of it have been formed in many places, and it is hoped that in some, at least, it will succeed and prove a valuable help to the people as providing an excellent food. It is rather difficult, however, to find the exact climate to suit it with the proper amount of moisture in the soil. A damp place in a hot, dry climate (like an African desert oasis) seems to be its favourite locality, and if it obtains that, it does not mind very hot winds at one season and frost at another. It can be grown from seed, but such a large percentage usually turn out male trees, that in making a date grove it is more satisfactory to use offsets from known female plants with only an occasional male. Such offsets are produced in abundance at the base of the stem, and can be taken off and planted separately. In this way, also, good varieties can be selected. The best kinds come from the Persian Gulf.

P. zeylanica, Trim.; Fl. Br. Ind. vi. 425; Trimen Fl. Ceyl. iv. 326; Vern. *Indi*, Cingh., is a rather short palm 8 to 20 ft. high, found in the moist low country of Ceylon, especially on the southern coast. The leaves are made into mats and boxes, and the fruit is eaten. *P. rupicola*, T. And.; Fl. Br. Ind. vi. 425; Gamble Darj. List 85; Vern. *Schiap, sap, fam*, Lepcha, is a graceful slender species, 15 to 20 ft. high and about 8 in. in diameter. It is found in the Sikkim Himalaya, chiefly on the steep cliffs of the lower hills around the Tista and Mahanadi rivers; also in Assam and the Mishmi Hills. The interior of the stem is eaten by Lepchas. *P. paludosa*, Roxb. Fl. Ind. iii. 789; Fl. Br. Ind. vi. 427; Brandis For. Fl. 556; Kurz For. Fl. ii. 536; Vern. *Hintal, hital*, Beng.; *Thinbaung*, Burm., is a soboliferous gregarious palm of the Sundarbans, Burma and the Andaman Islands. The stems are used for rafters, the leaves for thatch and to make ropes: the trade in them in the Sundarbans is considerable, and is valued at about Rs.8500 yearly (E 3643, Sundarbans). *P. farinifera*, Roxb. Fl. Ind. iii. 785; Fl. Br. Ind. vi. 426 (*P. pusilla*, Gaertn.; Trimen Fl. Ceyl. iv. 327); Vern. *Inchu*, Tam.; *Chilta-eita*, Tel.; *Ichal*, Kan., is a shrubby, very spinous, stemless dwarf palm of the sandy tracts on the Coromandel coast and in Ceylon. Its leaves are used to make mats, and its trunk gives a farina which is eaten. *P. acaulis*, Buch.; Roxb. Fl. Ind. iii. 783; Fl. Br. Ind. vi. 426; Brandis For. Fl. 555; Kurz For. Fl. 535; Gamble Darj. List 85; Talbot Bomb. List 202; Vern. *Khajúri, pind khajúr, jangli khajúr, palauti*, Hind.; *Takul*, Nep.; *Schap*, Lepcha; *Boichand*, Mar.; *Kojiri*, Uriya; *Keeta*, Kól, Sonthal; *Chindi, hindi, jhari sindi*, Gond; *Eeta*, Reddi; *Juno*, Kurku; *Thinbaung*, Burm., is a low palm with a thick bulbous stem found in a sub-Himalayan tract from the Jumna eastwards and up to 2500 ft., also in Central India, Behar and Burma. It chiefly grows in forests of Sál or Long-leaved pine in Northern India, on dry hill slopes in Central India and in Eng forest in Burma. The fruit is occasionally eaten, and a kind of sago obtained from the pith. *P. robusta*, Hook. f.; Fl. Br. Ind. vi. 427, is a wild date found by Sir J. D. Hooker on Parasnáth Hill in Chota Nagpore at 4000 ft. It has a trunk 15 to 20 ft. high, very thick, and densely covered with oppressed old leaf-sheaths. I have specimens collected in various places in the Gumsúr Valley, Ganjam, which have been kindly identified for me by Prof. Beccari, and he has also identified as this a specimen collected by Talbot in N.

Kanara. These three species, *P. acaulis*, *P. robusta* and *P. humilis*, are most difficult to distinguish, especially in dried specimens, which must of necessity be fragmentary. Speaking from the point of view, not of the botanist, but of the Forest observer, I recognize clearly two species: *P. acaulis*, which has a very short bulbous stem and very short peduncles, and *P. humilis*, which has a distinct stem and very long pedunculate flowers. This would include (1) the Siwalik plant with tall stems 10 to 12 ft. high, whose wood is here described under *P. humilis*; (2) the S. Indian plant (var. *pedunculata*, Becc.), which has quite short, but still distinct stems; (3) the tall-stemmed plant of the Circars, of which a fine patch is to be seen on the western side of Mahendragiri, and which may extend north to include the Chota Nagpore plants, and even *P. robusta* of Parasnáth; and (4) the Khasia Hills plant (var. *Loureirii*, Becc.), which I do not know personally, but which has a short stem. Sir Joseph Hooker has well said that more knowledge of the living plants is necessary for the proper identification and description of these puzzling wild dates.

1. **P. sylvestris**, Roxb. Fl. Ind. iii. 787; Fl. Br. Ind. vi. 425; Brandis For. Fl. 554; Kurz For. Fl. ii. 535; Talbot Bomb. List 202. The Wild Date Palm. Vern. *Khajúr, khaji, salma, thalma, thakil*, Hind.; *Pedda eeta*, Tel.; *Peria-eetcham*, Tam.; *Ichal, kullu*, Kan.; *Seimdi*, Berar; *Boichand, shindi*, Mar.; *Sindi*, Gondi.

An erect palm. *Stem* thick, densely covered with the bases of fallen leaves, or marked by prominent scars if they have fallen. *Wood* light brown, outer cylinder hard and rough, inner soft. *Fibro-vascular* bundles large, the horny part pale, shining, round or oval, with 3 to 5 pores at the inner border.

Cultivated all over India and Burma; wild in the Indus basin (Aitchison, see Fl. Br. Ind.); Talbot says, "certainly indigenous," as I too am inclined to think it is.

The common wild date-palm is one of the most conspicuous trees in India. It sometimes, if not tapped or damaged, grows very tall and graceful, reaching 40 to 50 ft. high and 1 to 2 ft. in girth. In some regions it is almost the only tree visible. In some places, as on salt lands and about springs in the Deccan, it covers considerable areas, forming a gregarious forest growth, and these areas are valuable, and are being reserved where they belong to Government. Where they come on private estates they give a considerable income. The reason for this is that they are tapped regularly for toddy, and this is either made into fermented liquor or is boiled down into sugar. In some cases, in South India, rights to tap existing date-trees (also palmyra) in Reserved Forests have been claimed and allowed. The tapping is done by cutting a notch in the soft wood at the base of the lowest living leaves, and a pot is tied on to catch the juice. The wound is renewed by cutting a fresh thin slice from time to time until exhausted. As this is done regularly, at intervals of two to three years, the stems of old trees have a curiously zigzag appearance, and the terminal tuft of leaves appears as if pushed to one side (see picture in Ind. For. xviii. 452, Article on the "Date Sugar Industry of Bengal," by Upendranath Kanjilal).

The wood is sometimes used for building, for water-pipes and other purposes, and the leaves are made into matting, ropes and baskets. Skinner gives (No. 104 with Madras wood) W = 39 lbs. per cubic foot, P = 512.

		lbs.
E 416.	Sundarbans (Richardson)	45
P 887.	Multán (Baden-Powell)	—
O 4567.	Saharanpur Botanic Garden (Gollan)	28

In Nordlinger's Sections, vol. 8, is a specimen of *P. dactylifera* with similar structure (Tab. XVI. 6).

2. **P. humilis**, Royle; Fl. Br. Ind. vi. 426; Talbot Bomb. List 202. Vern. *Khajúr*, Hind.

An erect palm. *Stem* sometimes short, sometimes reaching a considerable height, 10 ft. or more, covered closely with the bases of the petioles of fallen leaves, or marked with very prominent scars where these have fallen. *Wood* light brown, moderately hard. *Fibro-vascular* bundles small, many, the horny part small in section, white, rounded, with 2 to 5 pores in a group on the inner edge.

Hilly districts of India; Siwalik Range and Lower Himalaya; Assam, the Khasia Hills, Eastern Bengal and Burma; Chota Nagpore, Orissa and the Circars; Deccan Hills and Nilgiris, and the W. Ghâts from Kanara southwards.

A graceful species when well grown and with a well-marked stem; but sometimes nearly stemless. It has several varieties, for which see before.

		lbs.
O 4694.	Ranipur, Saharanpur Siwaliks (Gamble)	29
D 4188.	Cuddapah Forests (Gamble)	—

Tribe III. CORYPHEÆ.

Chamærops excelsa, Thunb.; Brandis For. Fl. 547, is a Chinese and Japanese fan palm often cultivated in Northern India. It is quite hardy up to 7000 ft. or more, and may be seen in gardens in Simla, Chakrata and elsewhere.

12. CORYPHA, Linn.

Four species, three of which are tall fan-leaved palms which die after flowering and fruiting. *C. elata*, Roxb. Fl. Ind. ii. 176; Fl. Br. Ind. vi. 428; Brandis For. Fl. 549 (*C. Gebanga*, Kurz For. Fl. ii. 429); Vern. *Bajúr, bajúr-batúl*, Beng., is a tall palm, said to be native of Bengal. Roxburgh describes two specimens which flowered when 30 years old; the first was 70 ft. high, the second 60 ft. to the base of the great terminal inflorescence. They were 8 ft. in circumference, and their whole stem was "strongly 'marked with rough dark-coloured spiral ridges and furrows, which plainly point out 'the spiral arrangement of the leaves." Only the outside wood is hard, the inside being soft and spongy. *C. Talliera*, Roxb. Fl. Ind. ii. 174; Fl. Br. Ind. vi. 428; Brandis For. Fl. 549; Vern. *Tara, talier, tarit*, Beng., is also a Bengal palm which has a straight trunk, about 30 ft. high, rough with impressions of the fallen leaves. The leaves are used to write on and to tie the rafters of native houses. *C. macropoda*, Kurz For. Fl. iii. 525; Fl. Br. Ind. vi. 429; Vern. *Dondah*, And., is a large stemless (in his For. Fl., Kurz says 8 to 12 ft. high!) palm found in the bamboo jungles of the western side of South Andaman. Dr. Prain found it also in the Coco Islands, but considers it to belong to *C. elata*, and he also, with the concurrence of Sir G. King, gives it as his opinion that *C. elata* is not really wild in India, and that the plants of it cultivated about Calcutta may have originally come from the Andamans (Journ. As. Soc. Beng. lx. ii. 331).

1. C. umbraculifera, Linn.; Fl. Br. Ind. vi. 428; Roxb. Fl. Ind. ii. 117; Brandis For. Fl. 549; Kurz For. Fl. ii. 524; Talbot Bomb. List 203; Trimen Fl. Ceyl. iv. 328. The Talipat Palm. Vern. *Conda-pani*, Tam.; *Sidalum*, Tel.; *Kodapana*, Mal.; *Biné, tali, shri-tali*, Kan.; *Tala*, Cingh.; *Pèlin*, Burm.

A tall fan-palm, with annulate stem. *Wood* soft, with a hard rind composed of black vascular bundles: those in the centre of the stem are soft, pale; those of the outside very hard and black, the horny part rounded, cordate in section, with 1 to 3 large pores.

Ceylon and the Malabar Coast. Cultivated in Bengal and Burma.

The Talipot palm, the largest and most imposing of Indian palms, is very common on the Malabar coast. Talbot says it covers extensive areas near Gairsoppa and Yena, also on the Yellapur Ghâts. It is often planted in gardens near the sea-coast, and flowers usually when about 40 years old. In Ceylon it is also common in the moist region, but is rarely seen in forest. It reproduces profusely, but as the leaves are so much cut, the seedlings get little chance of growing to maturity. The tree often grows to a great size before flowering; one whose measurements were given in the Indian Agriculturist for November 1878 as flowering at Peradeniya, Ceylon, measured: height of stem 84 ft., of flower panicle 21 ft., total 105 ft.; girth at 3 ft. from the ground round the persistent bases of the leaves 13 ft. 9 in., at 21 ft. from the ground 8 ft. 3 in.; age about 40 years. The leaves are very large, often 10 ft. in diameter; they are made into fans, mats and umbrellas, and are used for writing on. The horny globose seeds have the hardness of ivory. They are known as *Bajurbet* or *Bajurbatum* nuts,

and are made into necklaces and buttons and beads. From the Kanara ports they are exported to the Persian Gulf. A kind of sago is yielded by the pith.

		lbs
W 867.	South Kanara (Cherry)	42
W 4316.	Malabar (Morgan)	—

13. NANNORHOPS, H. Wendl. *N. Ritchieana*, H. Wendl.; Fl. Br. Ind. vi. 429; Talbot Bomb. List 203 (*Chamærops Ritchieana*, Griff.; Brandis For. Fl. 547); Vern. *Mazri, maizarai*, Trans-Indus; *Kilu, kaliún*, Salt Range; *Pfis, pesh, pease, fease, pfarra, pharra*, Sind, Baluch., is a gregarious tufted low-growing palm with branched stems or prostrate branching rhizomes 8 to 10 ft. long and 6 to 12 in. thick. It is found in Sind and the Western Punjab, on the Salt Range and about Attock, also in the Kuram Valley and in Baluchistan. In the latter region it covers many acres of country about Harnai, rising to 5500 ft. (Lace). The leaves are used to make matting, fans, sandals, baskets, hats and other articles; also to give a fibre which is made into ropes. The seeds are pierced and made into rosaries, and are exported in quantity for the purpose from the port of Gwadur to Mecca. The leafbud, young inflorescence and fruit are eaten. The dried trunks and foliage are used for fuel, being of some importance for that purpose in the arid countries where the palm grows. The scurf of the leaves, stalks, etc., is made into tinder with the addition of saltpetre. There are very fine large branching specimens of this palm in the Botanic Garden at Saharanpur, showing that it is capable of cultivation in Indian gardens.

14. LICUALA, Rumph.

Three species of low palms with flabellate leaves and annular stems. *L. longipes*, Griff.; Fl. Br. Ind. vi. 431; Kurz For. Fl. ii. 528, is a nearly stemless palm with large fan-shaped leaves and long stout petioles found in the forests south of Mergui. *L. spinosa*, Wurmb.; Fl. Br. Ind. vi. 431 (*L. paludosa*, Kurz For. Fl. ii. 528), is a gregarious palm with a trunk 4 to 8 ft. high and 2 to 4 in. in diameter, and thorny leaf-petioles, frequent in tidal forests on the coasts of the Andaman Islands. The well-known walking-sticks called "Penang Lawyers" are the young stems of *L. acutifida*, Mart. of the Malay Peninsula.

1. **L. peltata**, Roxb. Fl. Ind. ii. 179; Fl. Br. Ind. vi. 430; Kurz For. Fl. ii. 527; Gamble Darj. List 85. Vern. *Tale-lama*, Lepcha; *Patti, chatta-pat*, Ass.; *Kurud, kurkuti*, Beng.; *Salu*, Burm.; *Kápadah*, And.

A gregarious, fan-leaved palm. *Stem* annular. *Wood* rather soft, the fibro-vascular bundles dark-coloured and evenly distributed.

Lower Sikkim Himalaya; Assam, the Khasia Hills, Sylhet and Chittagong; tropical forests of Burma; Andaman Islands.

The Licuala palm reaches a height of 5 to 15 ft., but its stem is slender, only 2 to 4 in. in diameter. In Darjeeling it is scarce, and only found in the deep hot valleys near the Tista river; in Chittagong it forms a great part of the undergrowth in some forests, especially in the Kasalong reserve; and its leaves, under the name *Kuruchhpat*, are employed in the inner hill tracts for thatching, and, when grass is scarce, are exported. In Assam the leaves are made into umbrellas. In Burma and the Andamans they are used for thatching. They are also covered with the wood-oil of Eng or Kanyin, and used for torches in the Hlaine District (Brandis in Ind. For. i. 366).

E 3366. Kasalong Reserve, Chittagong (Gamble).
B 1046. Burma.

15. LIVISTONA, Br.

Two species. *L. speciosa*, Kurz For. Fl. ii. 526; Fl. Br. Ind. vi. 435; Vern. *Thalu*, Magh; *Taungtan, tawtan*, Burm., is an evergreen lofty fan-leaved palm, reaching 40 to 60 ft. of trunk, and a diameter of 1 to 2 ft., with orbicular flabellate leaves and annulate stem. It is found in the evergreen tropical forests of Chittagong and Burma, and its leaves are sometimes used as thatch. *L. chinensis*, Br. is a Chinese and Japanese species often cultivated in Indian gardens. Fine specimens may be seen at Dehra Dún.

It produces its olive-like seeds in great abundance, they germinate well, and the palm is very easy to grow, not minding the winter frosts.

1. **L. Jenkinsiana**, Griff.; Fl. Br. Ind. vi. 435; Gamble Darj. List 85. Vern. *Talainyom, tulac-myom, purbong*, Lepcha; *Toko pat*, Ass.

A large fan-leaved palm. *Stem* thick, grey, annulate. *Wood* very soft, with white fibro-vascular bundles.

Lower Sikkim Himalaya and eastwards to Assam, where it is chiefly common in Nowgong and the Naga Hills.

A very handsome palm, which is 20 to 30 ft. in height of trunk, and 6 to 12 in. in diameter. It is scarce in the Darjeeling Hills, where large specimens used to be found at the back of the big precipices above Sivoke. The leaves are very large, and are used by Lepchas for thatching and to make umbrellas. In Assam they are used to roof huts, boats and doolies, and to make the large Naga hats often 3 to 4 ft. in diameter called *jhapies*.

E 2461. Sivoke Hills, Darjeeling (Gamble).

16. TRACHYCARPUS, H. Wendl. Two species, both fan-leaved palms. *T. Martiana*, H. Wendl.; Fl. Br. Ind. vi. 436; Gamble Darj. List 86 (*Chamærops Martiana*, Wall.; Brandis For. Fl. 546, *C. khasyana*, Griff.; Kurz For. Fl. ii. 527); Vern. *Jhangra, jhaggar, tal*, Kumaon; *Taggu*, Newar; *Pakha*, Ass., is a tall slender palm with fan-leaves, a trunk 40 to 50 ft. high, and stem 6 to 12 in. in girth, found in the Central and Eastern Himalaya, at 6 to 8000 ft., from Kumaon eastwards, in the Khasia Hills and the hill tracts of Upper Burma and Martaban. In Sikkim I have only once found it, on the hills east of the Tista river. Its chief Himalayan locality is the Thakil mountain in Eastern Kumaon, in damp shady glens with a north-west aspect. *T. excelsa*, H. Wendl.; Fl. Br. Ind. vi. 436, is a similar species of Upper Burma with the stems covered with the bases of old leaf-sheaths.

TRIBE IV. LEPIDOCARYEÆ.

Metroxylon Sagus, Rottb. and *M. Rumphii*, Mart. are Malay palms, which give the "Sago" of commerce.

17. CALAMUS, Linn.

The Indian Rattan-canes belong to this genus and the next. In this genus there are 41 species, all but a few climbing palms. My best plan is, I think, simply to give a list, taken from Fl. Br. Ind. vi. 436.

No.	Name.	Distribution.	Remarks.
1	**C. erectus**, Roxb. Fl. Ind. iii. 774; Kurz For. Fl. ii. 516; Gamble Darj. List 86. Vern. *Sungotta*, Sylhet; *Rong*, Lepcha; *Thaing*, Burm.	Eastern Himalaya, from Nepal to Assam; Sylhet, Chittagong and the Khasia Hills; tropical evergreen forests of Burma.	An erect palm 12 to 18 ft. high, very thorny. Wood hard, with closely-packed fibro-vascular bundles, but of no use. —E 3377, Sivoke Hills, Darjeeling.
2	**C. Flagellum**, Griff.; Gamble Darj. List 86. Vern. *Reem*, Lepcha; *Nagagola bet*, Ass.; *Hudum*, Chittagong.	Eastern Himalaya from Nepal to Bhutan up to 3000 ft., Assam, Sylhet, and Kharia Hills to 4000 ft.; Chittagong.	Climber. Canes soft.
3	**C. arborescens**, Griff.; Kurz For. Fl. ii. 516. Vern. *Danôn*, Burm.	Marshy beds of streams in Pegu.	An erect palm, 15 to 20 ft. high, very thorny. Wood not used. — E 1028, Toungoo, Burma.

No.	Name.	Distribution.	Remarks.
4	**C. longisetus,** Griff. *C. tigrinus*, Kurz For. Fl. ii. 519. Vern. *Leme*, Burm.; *Amdah*, And.	Tropical forests of Burma, Andaman and Coco Islands.	Climber. Canes about 1 in. thick. — B 1042, Andamans.
5	**C. Thwaitesii,** Becc.; Trimen Fl. Ceyl. iv. 330; Talbot Bomb. List 204.	Most low country of Ceylon; evergreen forests of N. Kanara.	An erect palm.
6	**C. leptospadix,** Griff.; Gamble Darj. List 86. Vern. *Lat*, Lepcha; *Chemchun*, Bhutia.	Sikkim Himalaya in wet valleys and Terai swamps; Khasia, Naga, and Manipur Hills.	Climber. Canes thin and useless. Foliage feathery and graceful.
7	**C. rivalis,** Thw.; Trimen Fl. Ceyl. iv. 332. Vern. *Ela-wel*, Cingh.	Moist low country of Ceylon, scarce.	Climber with slender canes.
8	**C. pachystemonus,** Thw.; Trimen Fl. Ceyl. iv. 333.	Moist low country of Ceylon, scarce.	Climber. Canes slender.
9	**C. digitatus,** Becc.; Trimen Fl. Ceyl. iv. 334. Vern. *Kukula-wel*, Cingh.	Moist low country of Ceylon, scarce.	Climber. Canes slender.
10	**C. radiatus,** Thw.; Trimen Fl. Ceyl. iv. 333. Vern. *Kukula-wel*, Cingh.	Moist low country of Ceylon, common.	Climber. Canes slender.
11	**C. viminalis,** Willd. var. *fasciculatus*, Becc. *C. fasciculatus*, Roxb. Fl. Ind. iii. 779; Kurz For. Fl. ii. 517; Brandis For. Fl. 559. Vern. *Bara bet*, Beng.; *Pepa beti*, Palkonda; *Amla vetasamu*, Tel.; *Kyeinga*, Burm.	Lower Bengal; Orissa and the Circars; Chittagong and Burma; Andaman Islands.	Large climber. Canes thin but strong; make good walking-sticks.
12	**C. concinnus,** Mart.	Mergui.	Erect.
13	**C. floribundus,** Griff.	Assam, Mishmi and Khasia Hills and Sylhet.	Climber. Canes thin.
14	**C. pseudo-tenuis,** Becc.; Trimen Fl. Ceyl. iv. 330; Talbot Bomb. List 204.	Western Ghâts; low country of Ceylon.	Climber. Canes slender.
15	**C. delicatulus,** Thw.; Trimen Fl. Ceyl. iv. 332. Vern. *Nara-wel*, Cingh.	Low country of Ceylon, scarce.	Climber. Canes slender.
16	**C. Helferianus,** Kurz For. Fl. ii. 521.	Tenasserim or the Andamans.	Climber.
17	**C. nicobaricus,** Becc.	Nicobar Islands.	Climber. Canes very slender.
18	**C. tenuis,** Roxb. Fl. Ind. iii. 780; Brandis For. Fl. 559; Kurz For. Fl. ii. 520; Gamble Darj. List 86. *C. Rotang*, Linn.; Brandis For. Fl. 559 *part.* Vern. *Bet*, *bent*, Hind.; *Chachi bet*, Beng.; *Bandhari bet*, Chittagong; *Kring*, Magh; *Jalla bet*, Ass.; *Jali*, Cachar.	Sub-Himalayan tract from Dehra Dún eastwards; Assam, Sylhet, and Chittagong; Pegu.	Climber. Canes slender. The common rattan of Northern India, largely used for mats, screens, chair-seats, basket-work, blinds.—O 1038, Dehra Dún. E 1298, Cachar.
19	**C. Rotang,** Linn.; Roxb. Fl. Ind. iii. 777; Brandis For. Fl. 559; Talbot Bomb. List 204; Trimen Fl. Ceyl. iv. 331. Vern. *Pepa*, *prabba*, C.P.; *Priampu*, Tam.; *Wewel*, Cingh.	Central Provinces; Deccan and Carnatic; Konkan; dry places in Ceylon.	Climber. Slender canes. The common rattan of the South of India, used for basket-work, chairs, mats, blinds, etc., but is not strong.
20	**C. Brandisii,** Becc.	Courtallum in Tinnevelly at 3-5000 ft.	Climber. Canes slender.
21	**C. Feanus,** Becc.	Tenasserim.	Climber.

No.	Name.	Distribution.	Remarks.
22	**C. acanthospathus,** Griff.; Gamble Darj. List 86. Vern. *Gouri bet, pukka bet,* Nep.; *Rue, ru,* Lepcha.	Eastern Nepal; Sikkim Himalaya at 3-6000 ft.; Khasia Hills at 2-4000 ft.	Climber. The best of the rattan canes of Sikkim, better known by the name *C. montanus*, And. The canes are rather thick, and where obtainable are used for cane-bridges, chair-making, and walking-sticks, but are now scarce.
23	**C. Guruba,** Ham.; Kurz For. Fl. ii. 522. Vern. *Kyeinni,* Burm.; *Sundi-bet, quabi-bet,* Ass.	Bengal, Assam, the Khasia Hills, and Chittagong; all over Burma.	Climber. Canes slender. —B 1031, Toungoo. E 1299, Cachar.
24	**C. nitidus,** Mart.	Tenasserim.	Climber.
25	**C. platyspathus,** Mart.	Tavoy.	Climber.
26	**C. hypoleucus,** Kurz For. Fl. ii. 523.	Thaungyin Valley in Tenasserim.	Climber. Canes slender.
27	**C. myrianthus,** Becc.,	Mergui.	
28	**C. travancoricus,** Bedd.	West Coast, Malabar and Travancore.	Climber. Canes very slender.
29	**C. Rheedii,** Griff.	Malabar.	
30	**C. Huegelianus,** Mart.	Nilgiri Hills at 5-6000 ft., Sispara and Naduvatam.	Climber. Canes stout.
31	**C. Gamblei,** Becc.	Nilgiri Hills at 5000 ft., Makurti.	Climber.
32	**C. gracilis,** Roxb. Fl. Ind. iii. 781; Kurz For. Fl. ii. 520. Vern. *Mapuri bet,* Beng.; *Kraipang,* Magh; *Hundi bet,* Ass.	Khasia Hills up to 4000 ft., Assam, Cachar and Chittagong.	Climber. Canes very slender.
33	**C. melanacanthus,** Mart.	Tenasserim.	Climber.
34	**C. zeylanicus,** Becc.; Trimen Fl. Ceyl. iv. 335. Vern. *Mawewel, Wanderuwel,* Cingh.	Moist low country of Ceylon, common.	Climber. Canes stout.
35	**C. latifolius,** Roxb. Fl. Ind. iii. 775; Kurz For. Fl. ii. 518; Brandis For. Fl. 560; Gamble Darj. List 86. *C. macracanthus* and *C. inermis,* T. And. Vern. *Ruebee, groom, rabi,* Lepcha (*C. macracanthus*); *Dangri bet,* Nep.; *Brül,* Lepcha (*C. inermis*); *Korak bet,* Chittagong; *Sain,* Magh; *Yamata, yamata kyein,* Burm.	Sikkim Himalaya and Terai, and eastwards to Assam up to 2000 ft.; Eastern Bengal and Chittagong; tropical forests of Burma.	Climber. Canes stout, thick. The rattans are very strong and good, and are in use for walking-sticks, basket-work, timber-work, etc. In Sikkim two varieties are known, the *Ruebee* with broad leaflets, E 1017, Darjeeling Hills, and the *Brül,* the latter the best for making alpenstock canes. — E 1016, Darjeeling Hills. The ordinary kind, E 1004, Chittagong; B 1001, 1003, 1027, Burma.
36	**C. Doriaei,** Becc.	Burma.	Climber. Allied to *C. latifolius.*
37	**C. ovoideus,** Thw.; Hook. f. in Trimen Fl. Ceyl. iv. 335. Vern. *Tambutu-wel,* Cingh.	Moist low country of Ceylon, scarce.	Climber. Canes stout.
38	**C. andamanicus,** Kurz For. Fl. ii. 519. Vern. *Chowdah,* And.	Andaman, Coco and Nicobar Islands, common.	Climber. Canes very stout.
39	**C. palustris,** Griff.	Tenasserim; Andaman Islands.	Climber. Canes stout.

No.	Name.	Distribution.	Remarks.
40	**C. unifarius,** H. Wendl.	Nicobar Islands.	
41	**C. quinquenervius,** Roxb. Fl. Ind. iii. 777. Vern. *Hurnur-gullar*, Sylhet.	Sylhet.	Climber.

18. DÆMONOROPS, Blume. Three species, climbing palms with the appearance of *Calamus*. *D. Jenkinsianus*, Mart.; Fl. Br. Ind. vi. 462; Gamble Darj. List 86 (*Calamus Jenkinsianus*, Griff.); Vern. *Gola bet*, Ass.; *Gallah*, Cachar, is a stout species of the Darjeeling Terai (Dulka Jhar and Singari Pahar forests), Assam, the Khasia Hills, Eastern Bengal and Chittagong. The canes are long and rather soft, and are used for basket-work (E 1018, Darjeeling Terai, E 1300 Cachar). *D. Manii*, Becc.; Fl. Br. Ind. vi. 463, is found in the Andaman Islands. *D. Kurzianus*, Hook. f.; Fl. Br. Ind. vi. 463 (*Calamus grandis*, Kurz For. Fl. ii. 523), is a stout species of the tropical forests of the Andamans, giving useful canes and a kind of dragon's blood gum.

19. ZALACCA, Reinw. Three species: stemless, soboliferous, thorny palms. *Z. secunda*, Griff.; Fl. Br. Ind. vi. 472, is found in the Mishmi Hills, Upper Assam. *Z. Wallichiana*, Mart.; Fl. Br. Ind. vi. 472; Kurz For. Fl. ii. 511; Vern. *Yingan*, Burm., is common in the tropical forests of Burma. *Z. Beccarii*, Hook. f.; Fl. Br. Ind. vi. 474, is a Burmese species found near Rangoon.

20. KORTHALSIA, Blume. *K. laciniosa*, Mart.; Fl. Br. Ind. vi. 475; Kurz For. Fl. ii. 513 (*K. scaphigera*, Kurz For. Fl. ii. 513; Vern. *Bordah*, *paridah*, And., is a large thorny climbing palm of the forests of Tenasserim, the Andaman and Nicobar Islands.

21. PLECTOCOMIA, Mart. Four species, large, climbing, thorny palms, with conspicuously bracteate inflorescence. *P. khasyana*, Griff.; Fl. Br. Ind. vi. 478, is a large thick-stemmed species of the Khasia Hills at 4–5000 ft. *P. himalayana*, Griff.; Fl. Br. Ind. vi. 478; Gamble Darj. List 87; Vern. *Runool*, *ranól*, Lepcha, is a gregarious species of the Sikkim Himalaya, at 4–7000 ft.; very common about Darjeeling, but with soft canes of little use except occasionally for tying fences and for rough basket-work. *P. assamica*, Griff.; Fl. Br. Ind. vi. 479, is a large-leaved species of Upper Assam and of the Kachin Hills in Burma. *P. macrostachya*, Kurz For. Fl. ii. 514; Fl. Br. Ind. vi. 478, is a large species found on the Bithoko Hills in Tenasserim at 3000 ft.

22. PLECTOCOMIOPSIS, Becc. *P. paradoxus*, Becc.; Fl. Br. Ind. vi. 480 (*Calamus paradoxus*, Kurz For. Fl. ii. 521), is a large climbing palm of the evergreen tropical forests of Palawazeik in the Martaban Hills. It is distinguished from *Plectocomia* by the upper leaves being reduced to sheaths with long flagella, and by the scales of the fruit being exceedingly small.

Tribe V. BORASSEÆ.

Lodoicea seychellarum, Labill.; Brandis For. Fl. 545, is the "Double Coconut" of the Seychelles Islands. The half shell of its very curious fruit is a familiar object in India, as it is carried by wandering priests and pilgrims as a water-vessel, and may be very often seen at the great fairs at Hardwar and elsewhere. Formerly the shells used to be obtained from drifted nuts thrown up on the coast, but they are now imported.

23. BORASSUS, Linn.

1. **B. flabellifer,** Linn.; Fl. Br. Ind. vi. 482; Talbot Bomb. List 203; Trimen Fl. Ceyl. iv. 336. *B. flabelliformis*, Linn.; Roxb. Fl. Ind. iii. 790; Brandis For. Fl. 544; Kurz For. Fl. ii. 529. The Palmyra Palm. Vern. *Tál*, *tála*, *tár*, *taduka*, Hind.; *Tál*, Beng.; *Tád*, *tamar*, Mar.; *Potu tádi* ♂, *penti tádi* ♀, Tel.; *Panam*, *pannie*, *panei*, Tam.; *Pana*, Mal.; *Tali*, *talé*, Kan.; *Tad*, Guz.; *Tál*, Cingh.; *Tan*, Burm.

A large erect palm. *Stem* black, tall, cylindric, marked by the long semicircular scars of fallen leaves below, and above and in young trees by the dry spreading bases of the leaf-petioles; the upper part of the stem in old trees somewhat enlarged. *Wood* hard, black outside, light brown and soft inside, but not hollow. *Fibro-vascular* bundles black, rounded, the horny part cordate in section, with one large pore in the sinus; on a vertical section the wood is handsomely streaked.

Cultivated and run wild throughout the plains of India, Burma and Ceylon; most frequent in somewhat dry regions, as in Behar, the Circars and Carnatic, the Konkan and the north part of Ceylon: native of Africa.

The Palmyra palm is one of the most valuable and important of Indian trees, as it is one of the most striking of palms, with its fine crown of large fan-shaped leaves and dark stems. Though not "indigenous" it is distinctly "wild," and propagates itself readily from seed in regions where it is abundant, as it is, for instance, in the Nellore District on the Coromandel Coast, and about Jaffna in Northern Ceylon. In such regions it is capable of occupying waste land and forming forests, and it is most easy to form such forests artificially with some slight protection against cattle during reproduction, and a prohibition against the digging up of seedlings for food. Some areas of pure Palmyra have been reserved for permanent forest in South India, and are easily worked in selection, for timber, by the cutting of mature trees only and the filling of blanks by sowing seed. The exploitable age is probably about 50 to 60 years, perhaps less in some localities. If the palmyra forests are worked for both toddy and timber, it is usual to cut only those trees which are past tapping. As the tapping does not injure the wood in the same way as it does that of the date palm, this presents no difficulty, and a palmyra forest may be said to be a valuable property.

The Palmyra generally reaches a height of 40 to 60 ft., and may reach even 100 ft. and a diameter of 1½ to 2 ft. above the usually enlarged base. The enlargement at the base is caused by a network of root-fibres. The lower part of the tree is the hardest, the fibro-vascular bundles being there more numerous and more closely packed.

The following experiments have been made on the weight and transverse strength of the timber:—

		Weight in lbs.	Value of P.
A. Mendis, Ceylon, No. 83, bars 2′ × 1″ × 1″	found	65	814
Skinner, Madras, No. 30, 1862	"	65	944
Warth in 1878, No. W 2922	"	63	—
" " Salem, No. 15	"	72	—

The weights of all the pieces examined are given below, but Nos. W 2922 and Salem 15 were the only ones consisting entirely of the outer, harder wood. The average of all the specimens gives 49 to 50 lbs., which may be taken as the average weight of pieces containing partly outside, partly inside wood. The hollowed-out stems are used as water-pipes, and, split in half, for gutters and open water-channels. The hard outer wood is, in South India, in universal employ for posts, rafters and other purposes. The leaves are used for thatch, mats, umbrellas, fans, hats, sandals and basket-work, and for writing on. The pulp of the fruit, which resembles a natural jelly, is eaten, and in Ceylon is made into a preserve. Seemann says that the Dutch, when they had possession of Ceylon, considered the preserved pulp or *Punatoo* such a dainty that large quantities of it, preserved in sugar, were exported to Holland and Java. The chief product, however, of the Palmyra tree "is the sweet sap which runs 'from the peduncles cut before flowering and collected in bamboo tubes or earthen 'pots tied to the cut peduncle" (Brandis). Seemann says that in Ceylon the spathes are tied up from end to end with thongs, and then beaten and crushed between wooden battens for three successive mornings, that on each of the following four a thin slice is cut from the points of the spathes, while on the eighth day the sweet, clear sap begins to exude, and is caught in earthen pots or bamboos. The sap is fermented into toddy, is distilled, or is made into sugar known as "jaggery." The female tree gives a larger amount of sap than the male, perhaps one and a half times as much. The fibrous web at the base of young leaves is used for straining toddy and to make torches. The fibres from the petioles of the leaves and midribs are used in brushmaking, and are not unlike the South American "Piasába." The stem base is hollowed out and made into

water-buckets. The young seedlings are dug up and eaten as a vegetable after cooking or else ground into flour. The uses of the Palmyra palm are, in fact, almost as many as the uses of bamboo, and for an account of them Mr. W. A. Symonds' "Palmyra Palm and its Uses," in Madras Agri. Bulletin, No. 25, 1892, and Mr. E. Thurston's Report in Agri. Ledger, No. 20 (1894), may be consulted.

		lbs.
C 960.	Guzerat, Bombay (Shuttleworth)	42
E 418.	Jessore, Bengal (Richardson)	46
W 767, 869.	South Kanara (Cherry)	51
W 2922.	Malabar	63
D 1475.	Salem, Madras	25
B 563.	Prome, Burma (Ribbentrop)	49
B 2458.	Myanaung, Burma (Gamble)	31
No. 15,	Salem Collection	72
No. 83,	Ceylon Collection (old), No. 130 (new) (Mendis)	65

Tribe VI. COCOINEÆ.

Elæis guineensis, Linn.; Brandis For. Fl. 558, is the African palm which gives the Palm-oil of commerce.

24. COCOS, Linn.

1. **C. nucifera**, Linn.; Fl. Br. Ind. vi. 482; Roxb. Fl. Ind. iii. 614; Brandis For. Fl. 556; Kurz For. Fl. ii. 540; Gamble Darj. List 87; Talbot Bomb. List 202; Trimen Fl. Ceyl. iv. 337. The Coconut tree. Vern. *Narel, nariyal*, Hind.; *Narikel*, Beng.; *Tenna, tenga*, Tam.; *Nari kadam, tenkaia, kobbari*, Tel.; *Thenpinna, kinghenu, tengina*, Kan.; *Tenga*, Mal.; *Pol*, Cingh.; *On*, Burm.; *Jadhirdah*, And.

A large palm. *Stem* smooth, annulate, grey or greyish-brown, erect or curved. *Wood* hard, red outside; reddish-brown and softer inside, but not hollow; fibro-vascular bundles red, the horny part in section rounded or irregularly-shaped, cordate, with one or more large pores in the sinus; on a vertical section the wood is prettily streaked.

Cultivated in sea-coast regions of India, Burma and Ceylon; less so inland; probably native of tropical America.

The Coconut palm is not, like the Palmyra, a forest tree, though it may be seen practically in forest, grown in gregarious plantations all round the Indian coasts and on some of the islands like the Coco and Nicobars (not in South Andaman). The tree reaches a height of 30 to 40 ft., and a diameter of 1 to 2 ft. above the base, where it is thickened by a multitude of root-fibres. It is easily grown from seed, usually by allowing the nuts to germinate in water and then planting them in pits prepared with manure. They usually require to be regularly watered. Sometimes, after germination, they are put in nursery beds, and only planted out definitely after two or three years. The stems are rarely quite erect, but are generally seen to curve more or less in various directions. The leaves are pinnate, often 12 to 18 ft. long.

The following experiments have been made to determine the weight and transverse strength of the wood:—

		Weight. lbs.	Value of P.
Skinner in 1862, No. 49, with Madras wood	found	70	608
Puckle, 4 experiments in Mysore, bars 2′ × 1′ × 1″	"	47	562
A. Mendis, Ceylon, No. 72	"	70	—
Warth, in 1878, the average of 3 specimens examined	"	49	—

The wood is commercially known as "Porcupine wood;" it is used for rafters and ridge-poles, house-posts and other building purposes; for spear-handles, walking-sticks and fancy work. It makes very pretty and durable furniture. The leaves are used for thatching, and the net of fibres at the base of the petioles is made into bags and paper, and is used in Ceylon for toddy-straining. The cut flower-stalks yield toddy which is fermented or made into sugar; the kernels of the nuts are eaten, and the sweet fluid of the young nut is a pleasant drink; the thick fibrous rind of the fruit is the "Coir" fibre, used for ropes, mats and other articles; the shell of the nut is made

into spoons and cups and other utensils; while the oil obtained from the kernel is an important article of trade, and is used for burning, for cooking and in the manufacture of candles and soap. Dried in the sun, the kernel of the nut becomes "*copra*," an article of very considerable trade in the South Seas. To the native of many Indian and other tropical coast regions, the cultivation, tending and utilization of the Coconut palm is the business of life.

A small variety (var. *nana*) is found in the Maldive Islands of Ceylon.

The Coconut palm has several insect enemies. A scale insect, *Aspidiotus destructor*, Sign., does great damage to the trees in the Laccadive Islands, often in company with another species, *Dactylopius cocotis*, Maskell. On the coasts of South India, great damage is often done by the well-known "Rhinoceros beetle," *Oryctes rhinoceros*, Linn., which cuts large holes in the young shoots and stops their growth. Another destructive beetle is the large weevil, *Rhyncophorus ferrugineus*, Oliv.; and among other beetle enemies are *Sphenophorus planipennis*, Gyll., and *Batocera rubus*, Linn. The larva of the Hesperid butterfly, *Gangara thyrsis*, Fabr., does considerable damage to young Coconut palms on the Malabar coast.

	lbs.
E 417. Sundarbans (Richardson)	40
W 768, 868. South Kanara (Cherry)	55, —
D 4268. Madras (Gamble)	58
B 562. Burma (Ribbentrop)	52
No. 72, Ceylon Collection (old), 116 (new) (Mendis)	70

ORDER CXIII. PANDANEÆ.

Two genera, Pandanus and Freycinetia.

1. PANDANUS, Linn. f.

The Screw pines. There are six species properly known, and a few others imperfectly known or doubtful. *P. fœtidus*, Roxb. Fl. Ind. iii. 742; Fl. Br. Ind. vi. 483; Kurz For. Fl. ii. 506; Trimen Fl. Ceyl. iv. 340; Vern. *Keur-kanta*, Hind.; *Kea-kanta, kotki-kanta*, Beng.; *Thagyet, tawthagyet*, Burm.; *Dumukeyiya*, Cingh., is a densely-branched shrub of Assam, the Khasia Hills, Eastern Bengal, Burma and Ceylon. *P. ceylanicus*, Solms; Fl. Br. Ind. vi. 484; Trimen Fl. Ceyl. iv. 339; Vern. *O-keyiya*, Cingh., is a tall slender Ceylon species found in the beds of streams and planted on the edges of rice-fields. *P. minor*, Ham.; Fl. Br. Ind. vi. 485; Gamble Darj. List 87, is a dwarf species of hot valleys and wet places in the Sikkim Himalaya, Assam and Eastern Bengal. *P. andamanensium*, Kurz For. Fl. iii. 507; Fl. Br. Ind. vi. 485, is a very large species which grows to a height of 60 to 70 ft., and has a diameter of 12 to 18 in., and is only slightly provided with aërial roots. It is common in tropical forests of the Andaman Islands, especially near the sea.

The wood consists of cellular tissue and fibro-vascular bundles, the latter usually showing 2–3 large pores, embedded in a rounded or oblong mass of horny tissue.

1. **P. furcatus,** Roxb. Fl. Ind. iii. 744; Fl. Br. Ind. vi. 484; Kurz For. Fl. ii. 507; Gamble Darj. List 87. Vern. *Jarika*, Nep.; *Bor*, Lepcha.

A tall screw pine with branching stems 10 to 20 ft. high, and numerous aërial roots. *Trunk* smooth, with a thin bark layer, light brown. *Wood* soft, outer layers moderately hard, fibro-vascular bundles white, satiny, the horny parts rounded with two or three pores.

Valleys of the Sikkim Himalaya at 2–5000 ft.; Assam, Khasia and Naga Hills, Sylhet and Chittagong; tropical forests of Burma up to 2000 ft.

This is a very striking, handsome plant, and has a diameter of 4 to 6 inches. It is sometimes cultivated for ornament.

	lbs.
E 473, 2462. Darjeeling Hills (Manson and Gamble)	30

2. **P. odoratissimus,** Linn. f.; Trimen Fl. Ceyl. iv. 339; Kurz For. Fl. ii. 508; Roxb. Fl. Ind. iii. 738. *P. fascicularis*, Lam.; Fl. Br. Ind. vi. 485. Vern. *Keura*,

Hind.; *Kea, ketuki, keori*, Beng.; *Mugalik*, Tel.; *Thalay, talai, talum*, Tam.; *Kaida, thala*, Mal.; *Satthapu*, Burm.; *Mudu-keyiya*, Cingh.

A much-branched screw pine, shrub or small tree, with numerous aërial roots. *Stem* light brown, smooth. *Wood* light brown, moderately hard outside, very soft inside; fibro-vascular bundles somewhat concentrically elongate, rounded, with usually 2 pores in each, the harder part white satiny.

Sandy coasts of South India, Burma and the Andamans.

This is the common screw pine, forming dense impenetrable thickets in tidal forests and extensively grown as a hedge-plant in coast districts, and cultivated in gardens on account of the strong fragrance of its flowers, of which the natives of India are very fond. The women wear the panicles in their hair, and they are much employed in temples. They may be seen for sale in native shops and at Indian railway-stations. The leaves give an excellent fibre which is used for nets, sacks and brushes. The soft floral leaves are eaten as a vegetable, and the pulp of the fruit is also eaten.

W 4131. Gudalur, South-East Wynaad (Gamble).

2. FREYCINETIA, Gaud.

Four species, slender climbing shrubs, climbing by means of aërial roots. *F. angustifolia*, Bl.; Fl. Br. Ind. vi. 487, is found in Tavoy. *F. insignis*, Bl.; Kurz For. Fl. ii. 509, is a large species of the Andamans. *F. pycnophylla*, Solms, and *F. Walkeri*, Solms, are found in Ceylon.

ORDER CXIV. **GRAMINEÆ.**

The grasses constitute one of the largest and most important families of the vegetable kingdom, containing plants of every size from the tiny herbs of the meadows to the giant bamboos of the forests of Burma. In most forest regions of India, tall grasses cover the greater part of such land as is not too densely shaded with trees to prevent their growth; these tall grasses are found, like the species of *Arundo* and *Saccharum*, near the banks of streams; or, like the *Anthistiria* and *Andropogon*, in drier localities, covering sometimes large extents of land and rendering it liable to the evil effects of jungle fires. Such grasses have, however, many uses, and chief among them that of providing material for thatching, for in some parts of India not only the roofs but even the walls of all village houses are made of grass. Some are used as fibre plants, as giving essential oils, and as food or fodder, and a brief enumeration of some of the largest, most conspicuous and most important seems called for. Finally, there is the large tribe of bamboos, which are, almost everywhere in India, of the utmost importance in Forest economy. Grasses are divided into two Series, and these again into eleven Tribes:—

Series A. Panicaceæ.	
Tribe I. Paniceæ	Panicum, Thysanolæna, Spinifex, Pennisetum.
„ II. Oryzeæ	Oryza.
„ III. Zoysieæ.	
„ IV. Andropogoneæ . . .	Coix, Zea, Imperata, Miscanthus, Spodiopogon, Saccharum, Erianthus, Ischæmum, Andropogon, Anthistiria.
Series B. Poaceæ.	
Tribe V. Phalarideæ.	
„ VI. Agrostideæ	Aristida.
„ VII. Aveneæ	Avena.
„ VIII. Chlorideæ	Cynodon, Eleusine.
„ IX. Festucaceæ	Arundo, Phragmites, Triraphis, Eragrostis.
„ X. Hordeeæ . . .	Triticum, Hordeum.
„ XI. Bambuseæ.	
Sub-tribe I. *Arundinarieæ* .	Arundinaria, Phyllostachys.
„ II. *Eubambuseæ*	Bambusa, Thyrsostachys, Gigantochloa, Oxytenanthera.

Sub-tribe III.	*Dendrocalameæ* .	. Dendrocalamus, Melocalamus, Pseudostachyum, Teinostachyum, Cephalostachyum.
„ IV.	*Melocanneæ* .	. Dinochloa, Melocanna, Ochlandra.

The genera of grasses above mentioned have been selected as containing species of economic importance, and some of them are noticeable for containing the species which give the chief cereal crops of the country. They are: *Oryza sativa*, Linn., the Rice plant; *Triticum vulgare*, Vill., the Wheat; *Hordeum vulgare*, Linn., the Barley; *Avena sativa*, Linn., the Oat; *Zea Mays*, Linn., the Maize; *Andropogon Sorghum*, Brot., the "*Juár*" millet; *Pennisetum typhoideum*, Rich., the "*Bájra*" millet; *Eleusine Coracana*, Gaertn., the "*Mandua*" or "*Ragi*" millet. The Sugarcane is the produce of *Saccharum officinarum*, Linn. *Cynodon Dactylon*, Pers. is the "*Dúb*" grass, the chief and best of the pasture- and fodder-grasses of the plains.

The grasses which form the forest savannahs, and which are found in blanks and in open forest, belong to many species; and here I need only mention a few of the most important. One of the largest, perhaps the largest of the grasses of the drier savannahs in Northern India, is *Anthistiria gigantea*, Cav., which has stems reaching 10 to 16 ft. in height, with large panicles of oat-like flowers. Not much smaller is *Andropogon Nardus*, Linn., found all over India, Burma and Ceylon, and giving, like the allied *A. Schœnanthus*, Linn., which is equally widely distributed, the aromatic "*Rusa*" oil. In some parts of the Indian forests, the collection of the leaves of these grasses and the expression of their oil is an important Forest industry. Among other large grasses found in forest blanks may be mentioned *Panicum antidotale*, Retz; *Imperata arundinacea*, Cyrill.; *Erianthus Ravennæ*, Beauv.; *Saccharum fuscum*, Roxb.; *Andropogon intermedius*, Br., *A. serratus*, Thunb.; *A. squarrosus*, Linn. f., the "khaskhas" grass, whose roots give the fragrant fibres of which mats and bracelets are made, the wetted mats being used in the hot season to cool the rooms of Indian houses; *A. Gryllus*, Linn., chiefly found, as also is *Spodiopogon dubius*, Hackel, on the Himalayan slopes; *Andropogon contortus*, Linn., the well-known "Spear-grass," and *Triraphis madagascariensis*, Stapf. These great grasses and many others are those which are so liable to be burnt and difficult to extinguish when burning.

In swampy lands, there are some very large species of considerable importance. The largest of all are perhaps the great reed-grasses, *Arundo Donax*, Linn. and *Phragmites Karka*, Trin., known as "*Nal*" grass and extensively used in mat-making. But the most important is *Saccharum arundinaceum*, Retz. the "*Múnj*" whose exploitation, especially in Northern India, is a very important Forest industry. The stems, peeled of their sheaths, are used for matting, and the sheaths give a fibre which is made into carpets, ropes, mats, string, and both together are worked up into chairs and stools, tables and screens. Another most important fibre-grass, found over large areas in the drier forest lands of India, is the "*Bhabar*" grass, *Ischæmum angustifolium*, Hack., found in the Lower Himalaya, the Siwaliks, Rajputana, the C.P., Behar, Chota Nagpore, Orissa and the Circars, and yielding a very important paper material of quality similar to the "Alfa" of Algeria and the "Esparto" of Spain (*Macrochloa tenacissima*, Kth.). It is also made into ropes and mats, and its exploitation is a valuable industry.

A few other grasses deserve mention. *Thysanolæna Agrostis*, Nees, is a large grass with broad bamboo-like leaves and dense panicles of very small flowers, found in shady places in the forests almost all over India. The leaves are used for fodder, and the flower-panicles for brooms, especially in Hindu temples. *Aristida* is a genus with several species covering large areas in the very dry regions, the largest of which is *A. cyanantha*, Steudel, found in the beds of streams in the Lower Himalaya and Siwaliks, and also used to make brooms. *Eragrostis cynosuroides*, Beauv. is the "*Darbh*" grass common on waste lands in the drier regions almost throughout India, important in Hindu religious ceremonies, and used to give a fibre. *Coix Lacryma-Jobi*, Linn. is a broad-leaved grass of wet places which gives hard grey fruits used for making bead necklaces. Finally, *Spinifex squarrosus*, Linn. is a hard large grass found on the coasts, and of considerable importance in binding and fixing the blown sand.

Tribe XI. BAMBUSEÆ.

In the following account of the species of Indian bamboo so far known, I have endeavoured to be as brief as possible. For more information, reference is invited to the "Bambuseæ of British India" in vol. vii. of the "Annals of the Royal Botanic

Garden of Calcutta;" to Kurz' paper on "Bamboo and its Uses" in "Ind. Forester," vol. i., as well as to many other papers and letters and pieces of information on the Tribe scattered through the pages of that Magazine; to the charming account of the species cultivated in Europe given in the "Bamboo Garden" by Mr. A. B. Freeman-Mitford, C.B. (published 1896); and to the work on "Les Bambous" by Messrs. A. and C. Rivière. It is necessary to be brief, because if I were to try to quote anything like completely the information on record, it would require three times the space available. There is scarcely any Tribe of plants in the Indian Forests of such great importance in forest economy as the Bamboos, whether from the point of view of sylviculture or from that of utilization. The chief Indian bamboo is that of the deciduous forests, *Dendrocalamus strictus*; the chief species in Northern Bengal and Assam is *Dendrocalamus Hamiltonii*; in Eastern Bengal and Chittagong the most common kind is *Melocanna bambusoides*; in Burma, besides *Dendrocalamus strictus*, *Bambusa polymorpha* and *Cephalostachyum pergracile* are the chief associates of teak. In Central and South India, the valleys produce magnificent clumps of the thorny *Bambusa arundinacea*.

As regards the wood-structure, it resembles that of the palms, but the fibro-vascular bundles are more complicated. The culms of bamboos have a smooth outer surface, and are jointed at intervals, the nodes of the joints showing more or less prominent rings, and at the nodes the wood is solid. In the internodes, the culms are hollow, the cavity being cylindrical. On the transverse section, a bamboo shows the form of a ring whose outer portion is hard, and made up of fibro-vascular bundles with no or few pores, and a very little intervening parenchyma. Proceeding from the exterior towards the interior, the wood becomes softer, the bundles larger, and they consist usually of about 4 rounded masses of bast tissue surrounding smaller horny masses, which again enclose about 3 large pores arranged in a rough cross, with a fourth which is generally subdivided. By degrees the bundles are separated by more and more parenchyma until the interior part of the ring consists of parenchyma only. The shapes and arrangement of the fibro-vascular bundles are variable, so that specific characters based upon them seem impossible to obtain.

The nodes of bamboos bear culm-sheaths which will be found very interesting in form, and usually characteristic. The leaves are all grass-like, of various degrees of length and breadth. The flowers are irregular; in a few species they come annually, in most they come at long intervals, and then all the clumps in a locality usually flower together and seed and die.

The cultivation of bamboos is easy; it is done by seed or by offsets, in some cases by cuttings or layers. If the seed is good it germinates easily, and seedlings are easy to rear and easy to transplant in properly prepared ground; but as general seeding years are scarce, it is necessary to wait for seed, and therefore propagation by offsets is quicker. In the case of those species which flower and seed both generally at long intervals, and occasionally sporadically, such as *Dendrocalamus strictus* and *Hamiltonii*, the sporadic flowerings give very little if any fertile seed, so that it is necessary to wait for general flowerings, as with the rest. Offsets consist usually of a portion of an old culm with its roots, cut off above a joint at about 1 to 2 ft. above the ground, and the shoots come from dormant buds at the base of the culm. Such offsets are best taken and planted in the season of rest, so that the season of active vegetation which usually begins in the early days of the rains may find them well in position and capable of taking root well. Offsets taken in the rainy season after new growth has started usually fail. Cuttings are usually made by planting one or more internodes, the lowest bearing root-buds capable of growing; while layers, the more usual method of propagation with some species (e.g. *Bambusa vulgaris*), are made by partly cutting and laying a culm in the ground so that it may take root at the nodes. When the shoots have appeared and are strong-growing, the internodes are cut and the layers planted separately. A bamboo plantation succeeds best where moderate shade is available. In the cavity of the joints of some species of bamboo, especially *Bambusa arundinacea*, is found a white silicious substance known as "*Tabasheer*." It is used in China and elsewhere as a medicine.

Sub-tribe I. ARUNDINARIEÆ.

1. ARUNDINARIA, Michx.

Erect, occasionally climbing, shrubby species, found, with very few exceptions, in the hill regions. Four species are so far known to occur in the West Himalaya; 16 in the East Himalaya, Assam and the Khasia and Naga Hills; 3 in the South Indian mountains; 4 in Burma; and 5 in the mountains of Ceylon. There are 28 species altogether described in the Fl. Br. Ind., following the Monograph in vol. vii. of the "Annals of the Royal Botanic Garden of Calcutta." It will be best to give the species in the form of a list, taken from Fl. Br. Ind. vii. 376.

No.	Name.	Distribution.	Remarks.
1	**A. Walkeriana,** Munro; Bedd. Fl. Sylv. ccxxx.; Trimen Fl. Ceyl. v. 309.	Pulney Hills in S. India; Central Province of Ceylon at 5000 ft.	A small stiff species.
2	**A. Wightiana,** Nees; Bedd. *l.c.* ccxxx.; Trimen *l.c.* v. 309.	Nilgiri and other hills in S. India at 6–8500 ft.; Ceylon hills at 8000 ft.	The common Nilgiri shrubby species, flowers annually. Culms used for mats, baskets and fencing.
3	**A. floribunda,** Thw.; Bedd. *l.c.* ccxxx.; Trimen *l.c.* v. 310.	Hills of Ceylon at 5000 ft.	A shrubby small bamboo; scarce.
4	**A. elegans,** Kurz For. Fl. ii. 549. Vern. *Jilli*, Naga.	Naga Hills of Assam; hills of Upper Burma and Martaban at 5–7500 ft.	A small bamboo. Stems used for the walls of native huts.
5	**A. polystachya,** Kurz; Gamble Darj. List 87.	Sikkim Himalaya and Khasia Hills at 3–5000 ft.	
6	**A. debilis,** Thw.; Bedd. *l.c.* ccxxx.; Trimen *l.c.* 311.	Hills of Ceylon at 6–8000 ft., common.	A thin wiry-stemmed shrub. Very common about Newera Ellia. Leaves used for fodder for horses.
7	**A. densifolia,** Munro; Trimen *l.c.* 312, t. 100.	Anamalai Hills of S. India at 8500 ft.; hills of Ceylon.	A very small species. At Newera Ellia and elsewhere in Ceylon it grows like a reed on lake-banks.
8	**A. racemosa,** Munro; Gamble Darj. List 87. Vern. *Maling*, Nep.; *Phyum, miknu*, Lepcha; *Pheong, mheem*, Bhutia.	East Nepal and Sikkim Himalaya at 6–12,000 ft.	It may prove that there are two species here: (1) the big *Maling*, so much used in Darjeeling for pony-fodder, and which

has not yet been known to flower; and (2) the small high-level red-stemmed one, which flowered in 1857, 1887. The culms of the big var. reach 1 to 2 in. in diameter, and are used in making mats, etc. E 1351, 1354, Darjeeling, 8000 ft.

No.	Name.	Distribution.	Remarks.
9	**A. Griffithiana,** Munro; Gamble Darj. List 87. Vern. *Khnap*, Khasia.	East Himalaya, Khasia and Jaintia Hills at 3–4500 ft.	Nodes of stem thorny.
10	**A. Pantlingi,** Gamble; Gamble Darj. List 87.	East Himalaya, on Rechi La, at 11,000 ft.	Probably thorny.
11	**A. callosa,** Munro. Vern. *Uskong, uspar, spar*, Khasia.	Duphla Hills at 4–7000 ft.; Khasia Hills at 6000 ft.	Nodes of stem thorny.
12	**A. falcata,** Nees; Brandis For. Fl. 562. Vern. *Nirgal, nigâl, ringal, nagre, narri, garri, gero*, Hind.; *Spiug, gorwa, spikso, pitso*, Kunawar; *Ringalo*, Garhwal; *Nin-*	Western Himalaya, from the Ravi to Nepal at 4–7000 ft.	The common, more or less gregarious, low-level Ringal of the Western Himalaya with no transverse veinlets to the leaves. Often found in

No.	Name.	Distribution.	Remarks.
	galo, Kumaon; *Go-ningal*, Jaunsar.		flower. Used for basket-work, hookah-tubes, fishing-rods, etc. — H 132, Kulu.
13	**A. khasiana**, Munro. Vern. *Namlang*, Khasia.	Khasia Hills at 5–6000 ft., perhaps also in the Sikkim Himalaya.	Similar to *A. falcata*, but the stems stronger and harder and better for fishing-rods.
14	**A. intermedia**, Munro; Gamble Darj. List 87. Vern. *Titi nigala*, Nep.; *Parmiok*, Lepcha.	Sikkim Himalaya at 4–7000 ft., perhaps also lower.	Similar to the two last, and with strong hard stems; good for fishing-rods, baskets and mats. —E 1339, 3427, Darjeeling Hills.
15	**A. Hookeriana**, Munro; Gamble Darj. List 87. Vern. *Singhani*, Nep.; *Prong*, Lepcha.	Sikkim and Western Bhutan Himalaya at 4–7000 ft.	A large species, culms 12–15 ft. long and often over 1 in. thick.
16	**A. spathiflora**, Trin. *Thamnocalamus spathiflorus*, Munro; Brandis For. Fl. 563. Vern. *Ringal*, *deo ningal*, Jaunsar.	Western Himalaya, from the Sutlej to Nepal at 7–9000 ft., gregarious in undergrowth of fir, oak and deodar forests.	A useful kind, recognized from *A. falcata* by the conspicuously tessellate leaves. Used for pipe-stems, baskets, pea-sticks, etc. Flowering sometimes gregarious, sometimes sporadic.—H 131, Kulu.
17	**A. aristata**, Gamble; Gamble Darj. List 88. Vern. *Babain*, Lepcha; *Bhébham*, Bhutia.	Eastern Himalaya at 9–11,000 ft.	Stems strong, yellow; branchlets reddish. Stems used for pipes.—E 3426, Tonglo, 10,000 ft.
18	**A. Falconeri**, Benth.; Gamble Darj. List 88. *Thamnocalamus Falconeri*, Hook. f.; Brandis For. Fl. 563. Vern. *Pummoon*, Lepcha.	Central Himalaya from Jaunsar to Bhutan at 7–9000 ft.	A rather soft-stemmed species, not very common.
19	**A. Prainii**, Gamble. Vern. *Sampit*, *kevva*, Naga.	Naga and Jaintia Hills in Assam at 3500–8000 ft.	A semi-scandent, nearly solid-walled thin species, with usually 6 stamens.
20	**A. microphylla**, Munro.	Bhutan at 6–10,000 ft., perhaps also in Sikkim.	A gregarious low shrub.
21	**A. hirsuta**, Munro.	Khasia and Naga Hills at 5–9500 ft.	A small species.
22	**A. Gallatlyi**, Gamble.	Moolyet Hill in Tenasserim at 6000 ft.	A gregarious shrub.
23	**A. jaunsarensis**, Gamble. Vern. *Ningal*, Jaunsar.	Jaunsar in Western Himalaya, at Mundali, 7–8000 ft.	Recognized by its very long rhizomes.
24	**A. Rolloana**, Gamble.	Naga Hills in Assam at 5–7000 ft.	Also remarkable for very long rhizomes.
25	**A. armata**, Gamble. Vern. *Maitut*, Shan.	Hills of Upper Burma at 5500 ft.	The strong culms make good walking-sticks.
26	**A. suberecta**, Munro. Vern. *Lombnang*, *ukadai-namlang*, Khasia.	Sikkim Himalaya; Khasia and Jaintia Hills at 4–5000 ft.	A wiry species with rather tall thin culms.
27	**A. Kurzii**, Gamble.	Coasts of Tenasserim.	The only really low-level species — very little known.
28	**A. Mannii**, Gamble. Vern. *Beneng*, Khasia.	Jaintia Hills at about 3000 ft.	A climbing solid-stemmed species, remarkable for its very long sheaths.

The culms of *Arundinaria* are usually slender, the joints, unless studded with spines, not very prominent, the walls thin except in such species as *A. Prainii* and *A. Mannii*, which are climbing plants, and differ in appearance and character from the general type of the genus.

2. PHYLLOSTACHYS, Sieb. and Zucc. Two species occur in India: one, found in the Mishmi Hills of Upper Assam, has been identified with *P. bambusoides*, Sieb. and Zucc. of China and Japan; and the other, *P. Mannii*, Gamble; Fl. Br. Ind. vii. 386, is a very pretty species cultivated in the Khasia Hills at 5000 ft., and apparently wild in the Naga Hills. It has also been found by J. W. Oliver in Upper Burma at Bernardmyo, where it is called *Maipangpúk*, Shan. Both these species, but especially the latter, give excellent walking-sticks. The culms resemble those of *Arundinaria*, but the joints are much more prominent, and the internodes are more or less flattened on one side. The leaves have always transverse veinlets.

Sub-tribe II. EUBAMBUSEÆ.

3. BAMBUSA, Schreb.

This genus contains some of the most important of the Indian bamboos, and some of the largest. There are 22 species found in India, Burma and Ceylon, so far as is at present known, but two of these are introductions naturalized in the country. Some of them are difficult to distinguish when not in flower, and even the culm-sheaths, which are usually the best means of identification, are sometimes difficult to recognize. The following list is taken from Fl. Br. Ind. vii. 386, etc.:—

No.	Name.	Distribution.	Remarks.
1	**B. Tulda**, Roxb. Fl. Ind. ii. 193; Brandis For. Fl. 566; Kurz For. Fl. ii. 552; Gamble Darj. List 88. Vern. *Peka*, Hind.; *Tulda, jowa, kiranti, mutela, mitenga*, Beng.; *Mirtenga*, Sylhet; *Wamuna, wagi, nál-bans, deo-bans, bijuli, jati, jao, ghora*, Ass.; *Pepé siman*, Kól; *Makor*, Mal Pahari; *Bleeng*, Lepcha; *Wati*, Gáro; *Madaewah*, Magh; *Thaikwa*, Burm.	Bengal, Assam, Chittagong, Northern Circars, Burma; often cultivated.	In Lower Bengal the most common bamboo, with greyish-green culms 20 to 70 ft. high, and 2 to 4 in. in diameter, the cavity small. The culms are used for all general building purposes and in mat- and basket-making. The young shoots are sometimes eaten.—E 1333, Sundarbans; E 1328, Chittagong; B, 1321, Burma.
2	**B. nutans**, Wall.; Brandis For. Fl. 567; Gamble Darj. List 88. Vern. *Mahl*, Nep.; *Mahlu*, Lepcha; *Jiú*, Bhutia; *Bidhuli, mukial, mokal*, Ass.; *Seringjai*, Khasia; *Wa-malang*, Kuki; *Pichle*, Sylhet.	Sub-Himalayan tract from the Jumna eastwards, Assam, E. Bengal, in Sikkim to 5000 ft.	Has bright green culms 20 to 40 ft. high, 1½ to 3 in. in diameter, arising from long rhizomes rather far apart. It is much cultivated in Dehra Dún, and the culms are used there and elsewhere for all general purposes of building and mat- and basket-work. The walls are fairly thick, the diameter of the central cavity being usually about half that of the culm itself.—O 1338, Dehra Dún.
3	**B. teres**, Ham. Vern. *Bhaluki-makal*, Ass.	Assam and Eastern Bengal.	A large bamboo with culms up to 60 ft. in height and 3 in. in diameter, but they are rather soft and not much used in building.
4	**B. burmanica**, Gamble. Vern. *Thaikwa*, Burm.	Katha District of Upper Burma, on dry hill slopes.	A large bamboo with culms up to 50 to 60 ft. and 4 in. in diameter, in somewhat open clumps, pale green with a ring of hairs above the joint, cavity almost none below, large above average ¾ in. thickness of ring. It is now being cultivated at Dehra Dún, and seems useful.

No.	Name.	Distribution.	Remarks.
5	**B. polymorpha,** Munro; Kurz For. Fl. ii. 553. Vern. *Kyathaungwa,* Burm.; *Jama betuá,* Sylhet.	Eastern Bengal in Sylhet; upper mixed forests of Burma, often associated with teak.	A large bamboo, reaching a height of 50 to 80 ft. and a diameter of 3 to 6 in. The culms are greyish-white, scurfy when young, in very dense clumps. The culms are said to be the best in Burma for building.—B 1316, Toungoo.
6	**B. pallida,** Munro; Gamble Darj. List 88. *Dendrocalamus criticus,* Kurz For. Fl. ii. 559. Vern. *Pshi, paskipo,* Lepcha; *Bong shing,* Bhutia; *Wathai, walkthai, makal, bijli,* Ass.; *Watoi, tesero,* Naga; *Loto,* Mikir; *Usken, sken, tneng,* Khasia; *burwal, bakhal,* Cachar; *Gyawa,* Burm.; *Madankran, maipyu,* Kachin.	Sikkim Himalaya up to 3000 ft., and eastwards; Duphla Hills; Assam, Khasia Hills, and Sylhet; Upper Burma and Pegu; often cultivated.	A moderate-sized cæspitose bamboo, with olive-green culms up to 40 to 60 ft. in height, and 2 to 3 in. in diameter; cavity large and walls thin. It is much used in Assam for building, in mat- and basket-making, and for water-vessels.
7	**B. affinis,** Munro; Kurz For. Fl. ii. 551. Vern. *Theeshe,* Burm.	Eng forests of Martaban in Burma. In Calcutta it thrives on the muddy bank of the Hugli at the Botanic Garden.	A shrubby species, with pale green or striped culms 15 to 20 ft. long and 1 to 1½ in. diameter.
8	**B. khasiana,** Munro. Vern. *Serim, tyrah,* Khasia; *Tirriah,* Naga; *Wachiusa,* Cachar; *Bewah,* Mikir; *Chaltah,* Kuki.	Khasia, Jaintia, Naga and Manipur Hills of Assam up to 4000 ft.	A solitary-stemmed, soft species, with thin-walled dull green culms up to 30 to 40 ft. long and 1 to 1½ in. in diameter. It has a curious sheath with inflated pseudophyll. The culms are used in building and for basket-work.
9	**B. nana,** Roxb. Fl. Ind. ii. 190; Kurz For. Fl. ii. 551; Trimen Fl. Ceyl. v. 315. Vern. *Palawpinanwa,* Burm.	Wild in Malay Peninsula, indigenous in China; cultivated in many places in India and Burma.	A shrubby species, resembling *Arundinaria,* useful to make neat hedges.
10	**B. Balcooa,** Roxb. Fl. Ind. ii. 196; Brandis For. Fl. 567. Vern. *Balku,* Beng.; *Baluka,* Ass.; *Sil barúa, teli barúa,* Sylhet; *Wamnah, beru,* Gáro.	Assam, Lower Bengal and Behar, westward to the Gogra river; often cultivated.	A large, strong cæspitose bamboo, with greyish-green culms 50 to 70 ft. high and 3 to 6 in. in diameter, walls thick, the diameter of the cavity about one-third of that of the culm. The best species in Bengal for scaffolding and building in general. —E 1332, Jessore.
11	**B. vulgaris,** Schrad.; Bedd. Fl. Sylv. ccxxxii.; Brandis For. Fl. 568; Talbot Bomb. List 205; Trimen Fl. Ceyl. v. 314. Vern. *Basini, bansini,* Beng.; *Wanet,* Burm.; *Baridla,* Chittagong; *Sundrogai,* Uriya; *Uṇa,* Cingh.	Commonly cultivated in various places in India, especially in the Konkan. In N. India the golden-stemmed var. *striata* is more common.	A large, handsome species, with rather distant bright green, orange-yellow, or striped culms reaching 20 to 50 ft. in height and 2 to 4 in. in diameter; walls rather thin. It is used for building and other purposes.

No.	Name.	Distribution.	Remarks.
12	**B. Oliveriana,** Gamble. Vern. *Wapyusan*, Burm.	Hills of Upper Burma up to 2000 ft.	A pretty cæspitose species, with glossy green culms up to 40 to 45 ft. in height, and 1 to 2 in. in diameter, walls thick, diameter of cavity one-third that of culm.
13	**B. Binghami,** Gamble. Vern. *Ngachatwa*, Burm.	Tenasserim.	
14	**B. Kingiana,** Gamble. Vern. *Thaikwabo*, Burm.	Katha District of Upper Burma.	A large species, with culms up to 60 to 70 ft. in height and 4 in. in diameter.
15	**B. lineata,** Munro.	Andaman Islands, in marshy coast forests on Rutland Island; also in Java and elsewhere in the Malay Archipelago.	A reed-like shrubby bamboo, often found in flower, never yet in seed.
16	**B. schizostachyoides,** Kurz. *Cephalostachyum schizostachyoides*, Kurz For. Fl. ii. 565.	Tropical forests of South Andaman.	A moderate-sized bamboo, with tufted green stems 20 to 30 ft. high and 3 to 4 in. in diameter.
17	**B. Griffithiana,** Munro. *Dendrocalamus Griffithianus*, Kurz For. Fl. ii. 562.	Mogaung Valley in Upper Burma.	Said to have soft slender hollow culms.
18	**B. arundinacea,** Willd.; Roxb. Fl. Ind. ii. 191; Bedd. Fl. Sylv. ccxxxi. t. 321; Brandis For. Fl. 564; Kurz For. Fl. ii. 554; Talbot Bomb. List 205; Trimen Fl. Ceyl. v. 313. *B. spinosa*, Roxb. Fl. Ind. ii. 198; Bedd. *l.c.*; Brandis For. Fl. 566. *B. orientalis*, Nees.; Bedd. *l.c.* Vern. *Magar, nál*, Pb.; *Kattang*, C.P.; *Behor, ketúa, kataúsi*, Beng.; *Kotoha*, Ass.; *Wahkanteh, biru*, Gáro; *Kinkoit*, Cachar; *Wanah*, Magh; *Konta bansa*, Uriya; *Katanga*, Kól; *Mulsa veduru*, Reddi; *Kati wadúr*, Gondi; *Dongi, bidungalu, hebbidru*, Kan.; *Vedru, mulkás, mundla vedru, bongudu*, Tel.; *Múngil*, Tam.; *Kalak, kalki, padhai, khara, manwel, goda, kashti, mandgay*, Bombay; *Kyakatwa*, Burm.; *Illi*, Mal.; *Katauna*, Cingh.	Throughout India, Burma and Ceylon, except in the Himalaya and sub-Himalayan tract and the valleys of the Ganges and Indus; often cultivated and very ornamental.	A magnificent species, at once recognized by its thorns and its peculiar culm-sheaths. The culms are rather soft-wooded though stout, bright green; they reach 80 to 100 ft. in height and 6 to 7 in. in diameter, and have cavities in diameter nearly one-third of that of the culms. The forests are difficult to work because the culms interlace so much and are so much mixed up with thorny branchlets that they cannot easily be extracted singly. They are used for building, mats, baskets, and all sorts of purposes. Flowering years occur at intervals of about thirty years in any given locality, and the seed is eagerly

sought for as food. The leaves are sometimes attacked by an aphid, *Oregma bambusæ*, Buckton Ind. Mus. Notes iii. 87, which covers them with a black sticky gum.—O 1837, Dehra Dún; B 1319, Toungoo; W 1830, South Kanara. Weight of wood 45 to 50 lbs. per cubic foot.

No.	Name.	Distribution.	Remarks.
19	**B. auriculata,** Kurz. *Gigantochloa auriculata*, Kurz For. Fl. ii. 557. Vern. *Kalia*, Beng.; *Talaguwa*, Burm.	Assam, Sylhet, Chittagong and Burma; cultivated in Calcutta.	A moderate-sized tufted bamboo, with yellowish culms reaching 40 to 50 ft. in height and 2 to 2½ in. in diameter. It has

recently flowered in the Botanic Garden, Calcutta, and I think it will have to be transferred to *Oxytenanthera*, where it will be very near to, if not identical with, *O. nigrociliata*.

No.	Name.	Distribution.	Remarks.
20	**B. villosula,** Kurz For. Fl. ii. 558. Vern. *Tabendeinwa*, Burm.; *Wami*, Karen.	Limestone hills of Tenasserim and Martaban (Brandis).	A species with separate culms on long rhizomes, but little known.
21	**B. Mastersii,** Munro. Vern. *Benti*, Ass.	Dibrugarh in Assam (Masters).	Culms scandent, reed-like, but little known.
22	**B. marginata,** Munro. Vern. *Wame*, Karen.	Top of Daunat Range in Tenasserim at 5000 ft. (Brandis).	Culms scandent, dark-coloured.

4. THYRSOSTACHYS, Gamble.

Two species, both erect tufted graceful species.

1. **T. Oliveri,** Gamble; Fl. Br. Ind. vii. 397; Vern. *Thanawa*, Burm.; *Maitong*, Kachin, is found in the hills of Upper Burma, in moist forests, on ridges at 2000 ft., also in the Shan Hills. It has straight culms up to 50 to 80 ft. in height and 1½ to 2½ in. in diameter, the sheaths remaining persistent on the culm for long, and the nodes only very slightly thickened. The cavity has a diameter of half of that of the culm. The culms are excellent for building purposes, and the seed is eaten. A picture of a clump is given in Ind. For. vol. xx. (1894).

2. **T. siamensis,** *Gamble; Fl. Br. Ind. vii. 397;* Vern. *Tiyowa, kyaungwa*, Burm., is found in Burma from Mandalay down to Tenasserim. It has graceful culms 25 to 30 ft. in height and 1½ to 3 in. in diameter, usually covered with the persistent bases of the sheaths, and having the nodes not prominent. The cavity is rather more than half the diameter of the culm. This is the species used for the handles of state umbrellas carried by notable persons and priests, and it is often cultivated in monastery gardens for the purpose.

5. GIGANTOCHLOA, Kurz.

Two species. Besides these, *G. verticillata*, Munro is a Malay species of very large size, the culms attaining 80 to 100 ft. in height and 4 to 5 in. in diameter, and being greyish-green in colour, the younger ones striped with yellow, which is possibly to be found wild in Tenasserim, and is cultivated in the Botanic Garden, Calcutta, and elsewhere. The Malay species, *G. Atter*, Munro and *G. Apus*, Kurz, are also both cultivated in Calcutta. They are both very common in Java.

1. **G. macrostachya,** Kurz For. Fl. ii. 557; Fl. Br. Ind. vii. 399; Vern. *Tekserah*, Gáro; *Madi, madaywa*, Magh; *Wanet, wapyugyi, tabendeinwa*, Burm.; *Wabray*, Karen, is found in tropical forests in the Gáro Hills, Assam, Chittagong, Arracan and Burma. It is a fine bamboo with culms 30 to 50 ft. long, 2½ to 4 in. in diameter, dark green when old, glaucous when young. It is cultivated in Calcutta (B 1314, Toungoo).

2. **G. Kurzii,** Gamble; Vern. *Kobah*, Burm., is a little-known bamboo of Tenasserim and Malaya found near the coast. It was collected by Kurz on his last trip in 1878, and he does not mention the size, but Ridley says that in Province Wellesley the culms reach 20 ft. in length and 4 in. in diameter.

6. OXYTENANTHERA, Munro.

Seven species, aborescent or scandent bamboos with a stout, usually creeping and stoloniferous rootstock. The following list is compiled from Fl. Br. Ind. vii. 401:—

No.	Name.	Distribution.	Remarks.
1	**O. nigrociliata,** Munro; Bedd. Fl. Sylv. ccxxxiii. *Gigantochloa andamanica,* Kurz For. Fl. ii. 556. Vern. *Bolangi,* Uriya; *Washut,* Gáro; *Podáh,* And.	Orissa, Gáro Hills, Chittagong, Burma and the Andaman Islands.	A tufted bamboo. Culms 30 to 40 ft. long, ½ to 2 in. in diameter; dark green, sometimes striped with yellow; nodes prominent. Gregarious in the Andaman Islands. Used in the Gáro Hills for building and basket-work.—B 1331, Andamans.
2	**O. albociliata,** Munro. *Gigantochloa albociliata,* Kurz For. Fl. ii. 555. Vern. *Wa-pyugalé, wagók, waka, wanwè,* Burm.	Throughout Burma, common and often gregarious.	A tufted, straggling, bamboo. Culms 20 to 30 ft. long, ½ to 1 in. in diameter, greyish-green, curved. A species of very little value, sometimes troublesome in the Teak plantations.
3	**O. parvifolia,** Brandis. Vern. *Tseikdo-mindú,* Burm.; *Wamo,* Karen.	Yônzalin Valley in Burma (Brandis).	Apparently a large-sized bamboo, with culms up to 3 in. in diameter.
4	**O. Thwaitesii,** Munro; Bedd. Fl. Sylv. ccxxxii. t. 322; Trimen Fl. Ceyl. v. 316. Vern. *Watte,* Anamalais.	Hills of Kurnool; Hills of Western Ghâts from the Nilgiris southwards at 3500–6000 ft.; Central Province of Ceylon at 4–6000 ft.; common in Western Ghats and Ceylon, and usually gregarious.	A straggling, subscandent, gregarious, shrubby bamboo with whip-like branches, culms 10 to 12 ft. long or longer, about 1 in. in diameter. Of no value, but Beddome says the leaves are used for thatch on the Anamalais.
5	**O. monostigma,** Bedd. Fl. Sylv. ccxxxiii.; Talbot Bomb. List 205. Vern. *Choua, chumari, chiwa, chiwan, chawa,* Kan.; *Huda, udha, mangam, tandali,* Mar.	Western Coast and Western Ghâts from the Konkan to the Anamalai Hills, usually as undergrowth in deciduous forests.	A rather small bamboo, with isolated culms 10 to 15 ft. or more long by about 1 in. in diameter, velvety-tomentose, pale yellow; internodes long. The culms are used for basket-work, but are not very good.
6	**O. Stocksii,** Munro; Bedd. Fl. Sylv. ccxxxii.; Talbot Bomb. List 206. Vern. *Konda, més,* Kan.	The Konkan coast; Ghâts of N. Kanara; usually cultivated.	A slender bamboo with greyish-green culms, glabrous or softly pubescent. The culms are strong, and are used for punting-poles and for making umbrellas.
7	**O. Bourdilloni,** Gamble. Vern. *Pon mungil,* Tam.; *Arambu,* Mal.; *Kámbu,* Trav. Hills.	Ghâts of Travancore, at 3–4000 ft., on steep precipitous places.	A moderate-sized straggling bamboo forming open clumps, culms up to 2 in. in diameter. The sheaths are leathery.

Sub-tribe III. DENDROCALAMEÆ.

7. DENDROCALAMUS, Nees.

Moderate-sized, large or very large bamboos with densely branching root-stocks and flowers in globose clusters. There are 14 to 15 species, as in the following enumeration based on Fl. Br. Ind. vii. 403 :—

No.	Name.	Distribution.	Remarks.
1	**D. strictus**, Nees; Brandis For. Fl. 569, t. 70; Bedd. Fl. Sylv. ccxxxv. t. 325; Kurz For. Fl. ii. 558; Talbot Bomb. List 206. *Bambusa stricta*, Roxb. Fl. Ind. ii. 193. Male bamboo. Vern. *Báns*, Hind.; *Karail*, Beng.; *Salia bans*, *salimbo*, Uriya; *Bansár*, Koderma; *Mathan*, *saring*, *búrú mat*, Kól; *Mat*, Sonthal; *Marri*, *maringo*, Khond; *Konda veduru*, Reddi; *Bukhar*, Palamow (the clump); *Halpa*, *veddar*, *vadúr*, Gondi; *Indo*, Kurku; *Bhiru*, Baigas; *Kark*, Pandratola; *Kauka*, *sadanapa vedru*, Tel.; *Kal mungil*, Tam.; *Kiribidru*, Kan.; *Myinwa*, Burm.	Deciduous forests and dry and moderately dry regions all over India and Burma, except in Northern and Eastern Bengal and Assam. The most common and gregarious species. Var. *Prainiana* in the Cocos Islands (Prain). Var. *sericea* (*D. sericeus*, Munro; Fl. Br. Ind. vii. 404) on Mount Parasnáth in Behar at 4000 ft. (Hooker).	The male bamboo is deciduous. It is very variable in size of culm, size and pubescence of flower-heads, and in size of cavity. On dry hills like the Siwaliks, Mount Abu, etc., many of the culms are quite solid; in wetter places, as in Burma and the valleys of S. India, the culms are larger and have a distinct cavity. The culms reach 30 to 50 ft. in height and 1 to 3 in. in diameter; they are glaucous when young, yellowish when old, and they form very dense clumps, the tendency of culms on the outside often being to grow inwards and then again outwards higher up. This makes extraction from old clumps difficult, so that the aim of the forester in working bamboo forests is to keep the clumps as open as possible, when the culms will grow straighter, thicker and easier to extract. The subject has been very much discussed, and for further information various papers in the "Indian Forester" may be consulted. Usually, it is best to work by a yearly selection thinning bearing on culms of 2 years old and over. The bamboos are strong and elastic and in use for all purposes of building, basket- and mat-work, walking-sticks and "lathis," lance-shafts (the solid ones), furniture, agricultural and industrial implements, etc. The leaves are used for fodder and the dry culms and rhizomes for fuel. Usually, the male bamboo flowers gregariously in any given locality, but sporadic flowering is by no means uncommon, single clumps in flower being frequently found, often when the clump has been partly or wholly damaged. Sporadic flowerings, however, produce but little seed; for a quantity of good seed gregarious flowerings must be relied upon. The seed is eaten as a food grain in time of scarcity. In 1900, trees in Chanda C.P. were found to give a kind of manna, which was eaten. An analysis of 100 lbs. steam-dry wood made by Dr. Warth gave 2 lbs. of ash, of which 0·78 lb. was siliceous, 0·71 lb. phosphates of iron, calcium, etc., and the rest chiefly calcium carbonate with some soluble compounds of potassium and sodium. Dr. Romanis' analysis, made in 1885 (see "Ind. Forester," xii. 73), gave 73·73 per cent. silicic acid, 12·83 per cent. potash, 7·29 per cent. phosphoric acid, 3·94 per cent. lime and magnesia. (P 1352, Hoshiarpur, Punjab. B 1322, Burma.) The demand for culms of this species is very great. Dickenson ("Notes on the Flora of Berar") says that the Melghat outturn alone comes to 3,000,000 stems yearly, all *D. strictus*. The total outturn of the Indian forests is about 140 to 150 millions, of which at least 100 millions probably come from *D. strictus*.
2	**D. membranaceus**, Munro; Kurz For. Fl. ii. 560. Vern. *Wapya*, W. Burm.; *Wayè*, L. Burm.	Moist forests and low ground in Eastern Burma, from near Mandalay down to Tenasserim.	A graceful bamboo, forming more open clumps than *D. strictus*, and with culms spreading and arching outwards. The culms are light green, pubescent, and have a large cavity, in diameter three-fourths of that of the culm. The lower nodes are often constricted obliquely in alternate directions, and the curious *Bambusa constrictinoda*, Proudlock, may be this species, for my specimens agree well. The phenomenon may be seen in clumps in the School Park at Dehra Dún. The culms are used in building. B 1315, Toungoo.
3	**D. sikkimensis**, Gamble; Gamble Darj. List 88. Vern. *Tiria*, *vola*, Nep.; *Pagriang*, Lepcha; *Wadah*, Gáro.	Eastern Himalaya at 4–6000 ft.; Tura Peak in the Gáro hills, 3500 ft.; cultivated in many places in India and in Europe.	A very fine bamboo, with culms 50 to 70 ft. high and 5 to 7 in. in diameter, dark green. The sheaths are densely brown-felted. The culms are good, and sections of them are used in Sikkim to make "chungas" for carrying water and milk. The leaves are said to be poisonous to cattle.

No.	Name.	Distribution.	Remarks.
4	**D. Hookeri,** Munro; Brandis For. Fl. 570; Gamble Darj. List 88. Vern. *Kakaon*, N.-W. Him.; *Tili*, Nep.; *Patu*, Lepcha; *Ussey, assey denga, ukotang*, Ass.; *Kawa ule*, Kachin.	Sikkim Himalaya and eastwards; Assam, Khasia Hills, extending to Upper Burma in the Bhamo District, 2–5000 ft.; cultivated in the West Himalaya, in Garhwal (P. Mackinnon) and Kumaon (Fernandez).	A large bamboo, with culms 50 to 60 ft. high and 4 to 6 in. in diameter, dark green. The culms are made into water-buckets and used for general purposes. *D. Parishii*, Munro; Fl. Br. Ind. vii. 408; Brandis For. Fl. 570, is perhaps this species.
5	**D. Hamiltonii,** Nees and Arn.; Brandis For. Fl. 570; Gamble Darj. List 88. Vern. *Chye*, N.-W. Him.; *Tama*, Nep.; *Pao*, Lepcha; *Pashing*, Bhutia; *Pecha*, Beng.; *Kokwa*, Ass.; *Fondy*, Mikir; *Wanoke*, Gáro; *Wah*, Mechi; *Wabomyetsangyè*, Burm.	Central and Eastern Himalaya from Simla eastward (perhaps only cultivated west of Nepal) up to 3000 ft.; Assam, Khasia Hills and Sylhet; Katha, Bhamo and Ruby mines in Upper Burma.	The common bamboo of Northern Bengal and Assam. Culms up to 80 ft. long, 4 to 7 in. in diameter; white pubescent when young, grey-green when old; much curved and bent, and though sometimes erect and tall, more often forming thickets of nearly impenetrable growth. Culms used for all sorts of purposes of building, mat- and basket-making. The culms used to be much employed to help in floating heavy timber and sleepers down rivers like the Tista. The young shoots are eaten in Sikkim. The cavity in good culms is one-third of the diameter of the culm in lower joints. The flowers are purple, and sporadically flowering clumps, especially from injured specimens, are common. The young shoots are often badly damaged by a Curculionid beetle, *Cyrtotrachelus dux*, Behern. E 1341, 1466, Bamunpokri, Darjeeling Terai.
6	**D. patellaris,** Gamble; Gamble Darj. List 88. Vern. *Paqjiok*, Lepcha; *Footoong*, Mikir.	Sikkim Himalaya at 4000 ft.: Naga Hills in Assam.	A scarce but interesting moderate-sized bamboo, remarkable for the hairy plate at the nodes and the fringed sheaths. Culms 20 to 30 ft. high and 1 to 1¼ in. in diameter.
7	**D. giganteus,** Munro. Vern. *Worra*, Ass.; *Wabo*, Burm.	Tenasserim, Shan Hills and the Malay Peninsula; cultivated in the rest of Burma, also in Assam, Bengal, Malabar and Ceylon.	The biggest of the Indian bamboos. A forest of it, like the one near Myanoung on the Irrawaddy, is a truly fine sight. The culms reach 80 to 100 ft. in height and 8 to 10 in. in diameter; they are glaucous when young, greyish-green when old, and have large glabrous hard sheaths. The magnificent clumps of this bamboo in the Peradeniya Garden in Ceylon are justly celebrated. The culms make excellent pots for holding water and milk and are used in building.—B 1329, Moulmein.
8	**D. calostachyus,** Kurz For. Fl. ii. 562.	Upper Burma; Bhamo and Kachin Hills up to 3500 ft.	A tufted large bamboo very little known.
9	**D. latiflorus,** Munro. Vern. *Wani*, Burm.	Southern Shan States of Burma; cultivated at Maymyo; a Chinese species.	A very large bamboo; culms tall, 5 in. in diameter.
10	**D. longispathus,** Kurz For. Fl. ii. 561. Vern. *Khang*, Beng.; *Ora*, Chittagong; *Waya, talagu*, Burm.	Sylhet; Chittagong; Arracan; Burma, along streams and in upper mixed forests.	A large, often gregarious, bamboo, culms reaching 60 ft. in height and 3 to 4 in. in diameter, but with large cavity and walls only ¼ in. thick. The sheaths are thin and papery. Chester found it in the Chittagong Hill Tracts, covering large areas, over which it flowered gregariously in 1879. The culms are used for building and baskets. Brandis says they resist the attacks of insects. —E 1824, 3428. Chittagong Hill Tracts.

No.	Name.	Distribution.	Remarks.
11	**D. Brandisii,** Kurz For. Fl. ii. 560. Vern. *Kyelowa, waya, wabo,* Burm.; *Wakay, waklu,* Karen.	Burma, from the Kachin Hills southwards to the eastern slopes of the Pegu Yoma and Martaban Hills, up to 3500 ft.	A very large tufted bamboo, not usually, though nearly, as large as *D. giganteus,* with which it often is confused. Culms ashy-grey, up to 60 to 100 ft. high and 5 to 8 in. in diameter. It is, apparently, not much used.—B 1313, 1312, Toungoo.
12	**D. flagellifer,** Munro.	Moolyet Hill in Tenasserim, 2000 ft. (Bedd.); common in Malay Peninsula and Archipelago.	A very large species, closely allied to, and possibly identical with, *D. Brandisii.*
13	**D. longifimbriatus,** Gamble. Vern. *Myengwa, wapyau,* Burm.	Kyaukshát and Maliwáu forests in Tenasserim.	A large bamboo, the leaf-sheaths with conspicuously fringed auricles.
14	**D. Collettianus,** Gamble.	Fort Stedman and Taunggyi in Upper Burma.	Apparently a large species.

8. MELOCALAMUS, Benth. *M. compactiflorus,* Benth.; Fl. Br. Ind. vii. 409, (*Pseudostachyum compactiflorum,* Kurz For. Fl. ii. 567); Vern. *Daral,* Beng.; *Lota,* Chittagong; *Wanwè,* Burm., is a climbing bamboo of Sylhet, Chittagong and Arracan, and of the hill forests of the Ruby Mines District and of Martaban at 3–6000 ft. The culms are rough, thin-walled, extending to 100 ft. in length, but with only ½ to 1 in. in diameter. The seeds are large, fleshy, 1 to 1½ in. in diameter, often germinating while still on the tree. The culms are used in Sylhet for basket-work.

9. PSEUDOSTACHYUM, Munro. *P. polymorphum,* Munro; Fl. Br. Ind. vii. 409; Gamble Darj. List 88; Vern. *Filing,* Nep.; *Purphiok, paphok,* Lepcha; *Wachall,* Gáro; *Bajál, tolli, nál, basál,* Ass.; *Bawa, paukwa,* Burm., is a thin-walled shrubby bamboo of river-banks and valleys in the Terai and lower hills of Sikkim, rising to 3000 ft., and extending eastwards to Assam, the Gáro Hills, Manipur and Upper Burma (Myitkyina and Bhamo). It is easily recognized by the sheaths and by the very slightly prominent nodes, and is in considerable demand among tea-planters and others, as giving the best materials for estate and other basket-work. E 1340, Darjeeling Terai.

10. TEINOSTACHYUM, Munro.

Five species, shrubby or arborescent, erect, straggling or climbing. Three of the species are found in Assam and Burma, one in South India and one in Ceylon.

1. **T. Griffithii,** Munro; Fl. Br. Ind. vii. 410, (*Cephalostachyum Griffithii,* Kurz For. Fl. ii. 566); Vern. *Behti, beti,* Ass., is a graceful straggling or subscandent bamboo, the culms reaching 20 to 50 ft. in length and scarcely 1 in. in diameter, walls thin. It is found in Sibsagar and Dibrugarh in Assam, in the Khasia Hills, Chittagong and Upper Burma; perhaps also in the hills of Eastern Sikkim (Vern. *Rivett,* Lepcha). It is used in Assam for basket-work and to make pipes.

2. **T. Wightii,** Bedd. Fl. Sylv. ccxxxii. t. 323 (excl. Syn.); Fl. Br. Ind. vii. 410; Talbot Bomb. List 206; Vern. *Húda,* Mar.; *Wontenulgi,* Kan.; *Nanyura, meicetta, chitthu,* Trav. Hills, is a slender, tall, semi-scandent bamboo with culms up to 20 ft. long and 1 to 1½ in. in diameter, bright green. It is found on the slopes of the Western Gháts from N. Kanara down to Cape Comorin, usually at 3–5000 ft., and in the undergrowth of big-tree forest. Talbot says it is "much used in the construction of temporary bridges over the streams of the Gháts during the south-west monsoon;" but there may be some mistake, as he himself gives the maximum diameter of the culms at ¾ in.

3. T. attenuatum, Munro; Fl. Br. Ind. vii. 410; Bedd. Fl. Sylv. ccxxxiv.; Trimen Fl. Ceyl. v. 317, is a tufted bamboo with culms 12 to 25 ft. in height and ¼ to 1 in. in diameter, very slender. It is endemic in Ceylon, found in the Central Province at 4–6000 ft.; the culms are used for basket-making (Ferguson).

4. T. Dullooa, Gamble; Fl. Br. Ind. vii. 411; Gamble Darj. List 88; Vern. *Tokré bans*, Nep.; *Pogslo, paksálu*, Lepcha; *Wadru*, Gáro; *Silloh*, Jaintia; *Dolu, dulloua, bajail*, Beng.; *Thaikwaba, gyawa*, Burm., is a moderate-sized or large tufted bamboo, sometimes more or less scandent. The culms are dark green, reach 20 to 30 ft. in height and 1 to 3 in. in diameter. It is found in the East Himalaya from Sikkim to Assam, the Khasia and Jaintia Hills, Sylhet, Chittagong and Upper Burma. Major Lewin says the culms are "used for making mats, used in loading vessels 'with cargo;" in Assam they are used for basket-work, boxes to hold pán and in building.

5. T. Helferi, Gamble (*Pseudostachyum Helferi*, Kurz For. Fl. ii. 568; Fl. Br. Ind. vii. 411); Vern. *Wali*, Gáro; *Tumoh*, Khasia; *Wanwè, wathabut*, Burm., is an evergreen, tufted, bushy or climbing bamboo, remarkable as having the internodes of the culms sometimes as long as 4 ft., being the longest so far known in India. The culms reach 20 to 40 ft. in height and 1 to 1½ in. in diameter. It is found in the Gáro, Khasia and Jaintia Hills in Assam and in hill forests in Burma up to 3500 ft., and always in moist valleys, where it forms a dense almost impenetrable jungle. The culms are sometimes used for basket-work. B 1318, Toungoo.

11. CEPHALOSTACHYUM, Munro.

Seven species, shrubby bamboos with spikelets in globose or panicled heads, or in fascicles. They are all found in the Eastern Himalaya, Assam and Burma, one species only extending to the Peninsula, to the forests of Chota Nagpore. The following list is taken from Fl. Br. Ind. vii. 411:—

No.	Name.	Distribution.	Remarks.
1	**C. capitatum,** Munro; Gamble Darj. List 89. Vern. *Gobia, gope*, Nep.; *Payong*, Lepcha; *Sillea, sullea*, Khasia.	Sikkim and Bhutan Himalaya at 2–8000 ft.; Khasia, Jaintia and Naga Hills of Assam.	A graceful, small, gregarious bamboo, with culms 12 to 30 ft. long and 1 to 1½ in. in diameter and long internodes. It is used by Lepchas for bows and arrows, for which it is considered the best kind, also for basket-work. The leaves are used for fodder.—E 1353, 3429, Dumsong, Darjeeling.
2	**C. pallidum,** Munro.	Mishmi Hills, Khasia Hills, Patkoye Range and Manipur up to 5000 ft.	A graceful, small, shrubby bamboo.
3	**C. latifolium,** Munro; Gamble Darj. List 89.	Eastern Sikkim Himalaya, up to 5000 ft.; Manipur.	A shrubby, semiscandent bamboo with broad leaves.
4	**C. Fuchsianum,** Gamble; Gamble Darj. List 89. Vern. *Palóm*, Lepcha.	Hills of Eastern Himalaya at 6–8000 ft.; Daphla Hills at 6–7000 ft.; Kachin Hills of Upper Burma.	A moderate-sized, semiscandent bamboo, with soft thin-walled culms, large leaves and flower-heads and characteristic sheath.
5	**C. pergracile,** Munro; Kurz For. Fl. ii. 564. Vern. *Latang*, Naga; *Madang*, Singpho; *Tinwa*, Burm.	Singhbhúm forests of Chota Nagpore (Gamble); Sibságar Lakhimpur and Naga Hills in Assam; all over Burma, where very	A deciduous, arboreous, tufted bamboo, with glaucous-green culms 30 to 40 ft. high, 2 to 3 in. in diameter and rather thin-walled, the walls usually about ¼

No.	Name.	Distribution.	Remarks.
		common and often gregarious.	in. thick. It is one of the chief bamboos of Burma, and one of those

most frequently found in association with teak. It flowers usually gregariously, but also sporadically, though when thus flowering it rarely produces good seed, following in this the example of the Male Bamboo. The culms are used in building and mat-making and rice is often cooked in the joints to be easily carried on a journey. In Assam it is used for basket-work.—B 1317, Toungoo.

6	**C. flavescens,** Kurz For. Fl. ii. 564.	Burma, exact habitat unknown: cultivated in Calcutta, Madras, Dehra Dún and elsewhere. Kurz says, "introduced 'from Pegu," but I am inclined to think it is from the Andaman Islands.	An evergreen, tufted, arborescent bamboo, with greyish-green culms 20 to 30 ft. high and 1 to 1½ in. in diameter, or perhaps more. It forms dense clumps with a rounded head and a great number of shoots. See No. 1 clump at the corner of two roads in the bamboo grove in the R. Botanic Garden, Calcutta.
7	**C. virgatum,** Kurz For. Fl. ii. 565. Vern. *Waba*, Burm.; *Lakra*, Kachin.	Upper Burma, at Keouksik on the Mogaung river and in the Bhamo District J. W. (Oliver).	A moderate-sized, slender, tufted bamboo, with dark green culms up to 4 in. in diameter.

SUB-TRIBE IV. MELOCANNEÆ.

Besides the genera described, *Schizostachyum* contains several species found in the Malay Peninsula, some of which may eventually prove to extend to Tenasserim.

12. DINOCHLOA, Büse.

Two species, erect or scandent, one found in the Andaman Islands, the other in Chittagong and Burma.

1. **D. Tjankorreh,** Büse; Fl. Br. Ind. vii. 414 (*D. andamanica*, Kurz For. Fl. ii. 570); Vern. *Baradahbarat*, And., is an evergreen, lofty, climbing bamboo of the Malay Peninsula and Archipelago, whose var. *andamanica* is found in the Andaman and Nicobar Islands, where it forms dense nearly impenetrable thickets.

2. **D. M'Clellandi,** Kurz For. Fl. ii. 371; Fl. Br. Ind. vii. 414; Vern. *Wanwè*, Burm., is an evergreen, erect or scandent bamboo of Chittagong and Burma, the culms, which are often somewhat square in section, running up to 100 ft. in height and 1 to 2 in. in diameter, alternate joints bending different ways so as to give them a zigzag appearance. It is cultivated in the Royal Botanic Gardens of Calcutta and Ceylon. B 1320, Toungoo, Burma.

13. MELOCANNA, Trin.

Two species, arborescent bamboos, both of the Burmese region, the chief one extending to Chittagong and Assam.

1. **M. bambusoides,** Trin.; Fl. Br. Ind. vii. 417; Kurz For. Fl. ii. 569 (*Bambusa baccifera*, Roxb. Fl. Ind. ii. 197); Vern. *Múli, metunga, paia*, Beng.; *Tarai*, Ass.; *Wati*, Cachar; *Artem*, Mikir; *Turiah*, Naga; *Watrai*, Gáro; *Kayaungwa*, Magh; *Aworja*, Chakma; *Pagu-tulla*, Chittagong; *Kayinwa, Tabendeinwa*, Burm., is an evergreen arboreous bamboo with single, distant culms arising from the ramifications of an

underground rhizome. The culms are tall, straight, with very slightly raised nodes, green when young, straw-coloured when old, clothed with hard persistent sheaths with long acuminate pseudophylls, 50 to 70 ft. in height and 1½ to 3 in. in diameter. It is found in Eastern Bengal and Burma, *from* the Gáro and Khasia Hills *to* Chittagong and Arracan, and again in Tenasserim; but its real home is in the Chittagong Hill Tracts, where it is gregarious, covering large areas of country, and affording a valuable bamboo for building purposes, both locally and for export to Bengal. At least sixteen millions are yearly thus exported. It is excellent for building, basket-work and thatching, and having its culms single and not in clumps, its cutting and extraction are easy and cheap. The fruit is large, with a thick fleshy pericarp; it is often 3 to 5 in. long and 2 to 3 in. broad, pear-shaped, and germinates often before falling: it is sometimes eaten.—E 1325, Chittagong.

The young shoots of *Muli* are often badly attacked by a beetle, *Cyrtotrachelus longipes*, which kills them (J. P. Gregson in "Ind. For." xxv. 420).

2. **M. humilis,** Kurz For. Fl. ii. 569; Fl. Br. Ind. vii. 418; Vern. *Tabendeinwa*, Burm., is an evergreen tufted bamboo with culms reaching 8 to 15 ft. in height and about 1 in. in diameter. It is found in the upper mixed forests of Arracan and in Pegu, but is scarce and little known. The specimens much resemble a small variety of *M. bambusoides*, with which I cannot help thinking it will prove identical.

14. OCHLANDRA, Thw.

Six to seven species of shrubby, gregarious, reed-like bamboos, all of South India or Ceylon. The following list is compiled from Fl. Br. Ind. iii. 418:—

No.	Name.	Distribution.	Remarks.
1	**O. Rheedii**, Benth.; *Beesha Rheedii*, Bedd. Fl. Sylv. ccxxxiv. Vern. *Amma*, Mal.	West Coast of India in Malabar, Cochin and Travancore.	A shrubby, gregariou bamboo, with erec culms up to 16 ft. ir length and 1 in. ir diameter.
	Var. *sivagiriana*.	N. Kanara (Talbot); Pulney and Sivagiri Hills (Bedd.).	Apparently a larger bam boo in every respect and probably a separat species.
2	**O. stridula**, Thw.; Trimen Fl. Ceyl. v. 318. *Beesha stridula*, Bedd. Fl. Sylv. ccxxxiv. Vern. *Batali, battagass*, Cingh.	Low country in the south of Ceylon.	A close-growing, very gre garious shrub, wit erect culms 6 to 18 f high and ½ to ⅝ in. i diameter. They ar used for fences and roo of huts, and the leave for thatch.
	Var. *maculata*.		A variety with mottle culms, used for stick to make boxes and fanc articles, etc.
3	**O. Beddomei**, Gamble.	Wynaad in Malabar, S. India.	A little-known species.
4	**O. travancorica**, Benth. *Beesha travancorica*, Bedd. Fl. Sylv. ccxxxiv. t. 324. "Elephant Grass" of Travancore. Vern. *Eeral, irúl*, Tam.; *Eetta, vé*, Mal.; *Kár eetta*, Trav. Hills; *Irakalli*, Tinnevelly.	Mountains of S. India in Travancore and Tinnevelly at 3-5000 ft.; planted in Madras and Ceylon.	An erect, reed-lik shrubby, gregario bamboo, with culms to 20 ft. long, and 1 2 in. in diameter; ar very large fruit 2 i long and long-beake It sometimes has many as 120 stamer It covers considerab areas of country, and an excellent plant give paper fibre.
	Var. *hirsuta*.	Travancore Hills.	A variety with velve spikelets.

No.	Name.	Distribution.	Remarks.
5	**O. Brandisii,** Gamble.	Tinnevelly Ghâts at Courtallum, up to 3000 ft.	A little-known species.
6	**O. setigera,** Gamble.	Gudalúr, on the western slopes of the Nilgiris at 3000 ft., perhaps also Ceylon.	A small, tufted, erect or straggling bamboo. Flowers not yet known.

DIVISION II. CRYPTOGAMÆ.

Cryptogamic plants are divided into three Groups, viz.—

Group I.	Thallophyta,	including Class	1. Algæ.
		,,	2. Fungi.
,, II.	Bryophyta,	,, ,,	3. Hepaticæ.
		,,	4. Musci.
,, III.	Pteridophyta,	,, ,,	5. Filicinæ.
		,,	6. Equisetinæ.
		,,	7. Lycopodinæ.

Class 1, *Algæ*, contains plants of simple structure, chiefly living in the water, and in whose tissues chlorophyll is present. Except, perhaps, a few genera, such as *Nostoc*, which are sometimes found as parasites, the Algæ are of little or no interest from the forest point of view.

Class 2, *Fungi*, includes an immense number of plants, of various sizes and shapes and methods of growth and without chlorophyll. In Forest Economy, some of the Orders of Fungi are of very great importance, as they contain plants which are parasitic on forest trees and often seriously injure and even kill their hosts. This is not quite the place to go into a detailed description of those species which are so far known, but the chief of them have been mentioned in treating of the trees on which they chiefly grow. Lichens are Fungi living in symbiotic connection with minute Algæ, and are to some extent important in the forests from the way in which, in some localities, they cover the bark and branches of the trees.

Classes 3 and 4, the *Hepaticæ* and *Musci*, which may together be called the "Mosses," are small plants containing chlorophyll and growing on the ground, on rocks, on tree-trunks, etc. Mosses are of interest in Forest Economy either from their clothing the trunks of forest trees and thereby doing perhaps a certain amount of harm, or from their growing on the ground in the forests and being of importance in the formation of humus.

Class 6, *Equisetinæ*, contains the Horsetails, and Class 7, *Lycopodinæ*, the Club-mosses and Selaginellas. The Horsetails are common in wet places in many parts of the Indian forests, but of no particular importance; the Clubmosses and Selaginellas also are forest plants, the former containing species of *Lycopodium*, some of which are epiphytic on forest trees, and some covering banks and heaths with tangled growth.

Class 5, *Filicinæ*, contains the Ferns and some of their allies, and among the Ferns some are found which rise to the dimensions of trees and require to be noticed in this work. The Filicinæ are divided into 11 Orders, most of the important forest species coming in the Order *Cyatheaceæ*. For the purposes of this work it will suffice to keep the ferns together and treat them all as an Order *Filices*.

ORDER CXV. FILICES.

Ferns are extremely common objects in most of the Indian forests, only the most arid regions showing few or none. In damp tropical forests, ferns often form the chief part of the forest undergrowth; they also grow epiphytically on the branches of the trees or climb over the bushes and up the tree-trunks. In the drier deciduous forests, ferns may often be seen in the ground vegetation and in ravines. In the hill regions

of India, almost everywhere above 2–3000 ft. elevation, the well-known bracken, *Pteris aquilina*, Linn., probably the most widely spread plant in the world, covers the hillsides and forms the undergrowth of the more open forests, being of importance from its power of holding the soil with its strong rhizomes, which are difficult to get rid of for cultivation. And it is also in these hill regions, for the most part, that are found the beautiful tree-ferns, and also the densely-growing species of *Gleichenia*, *G. linearis*, Burm. and *G. glauca*, Hook., which often cover considerable areas of hill-slope with their matted fronds and strong wiry branches.

Among other species of ferns, which, though not exactly arborescent, are yet remarkable and of interest in the Indian forests, may be mentioned *Angiopteris evecta*, Hoffm., a thick fleshy fern of most of the moister regions of India, with a huge fleshy root-stock and leaves which often reach 6 ft. in length; as well as its relative *Marattia fraxinea*, Smith, of similar localities and growth in the forests of the Western Ghâts. *Acrostichum aureum*, Linn.; Vern. *Dhekwa*, *udoban*, Beng., is a handsome fern, used occasionally for thatching in the Sundarbans. *Asplenium polypodioides*, Mett. is a common large-leaved fern of the Himalaya, which has often a distinct stem of a few feet in height, and may also be ranked as a tree-fern. Conspicuous on trees in the forests of Burma is the Stag's Horn fern, *Platycerium Wallichii*, Hook.; also the Bird's Nest fern, *Thamnopteris Nidus*, Linn., which is also found to extend to the Khasia Hills and Eastern Himalaya, the Malabar Forests and Ceylon; while among other noticeable kinds are the climbing ferns of the genus *Lygodium*, chief among which is *L. flexuosum*, Sw., so common in the Sál forests and other deciduous forests almost throughout India.

The *Pteridophyta* are not given in the Fl. Br. Ind., but the ferns have been excellently described and often figured in Col. R. H. Beddome's "Ferns of British India, Ceylon, and the Malay Peninsula," and in its supplement. The other chief works on Indian ferns are the same author's two series of plates, "The Ferns of Southern India" and "Ferns of British India;" Mr. C. B. Clarke's "Review of the Ferns of Northern India" in Trans. Linn. Soc. i. 425 (1880), and Mr. C. W. Hope's Ferns of N.-W. India now under publication in the Journ. Bomb. Nat. Hist. Soc.

The genera of tree-ferns are four: Cyathea, Amphicosmia, Alsophila and Brainea.

1. CYATHEA, Smith. Five species. *C. sinuata*, Hook. and Grev. and *C. Hookeri*, Thw. are graceful, erect, small-stemmed species of Ceylon, with undivided leaves. *C. spinulosa*, Wall.; Bedd. Ferns 5; Kurz For. Fl. ii. 572, is a tall tree-fern found in various parts of India from the Khasia Hills, the hills of Pachmarhi (Duthie), the hills of the Circars and Godavari to Coorg, Kanara and the Wynaad up to 3000 ft. Clarke says it reaches 30 ft. in height. *C. decipiens*, Clarke and Baker in Jour. Linn. Soc. xxiv. 409 (*Amphicosmia decipiens*, Bedd. Ferns 10, *Hemitelia decipiens*, J. Scott; Clarke Trans. Linn. Soc. Ser. 2 i. 430; Gamble Darj. List 89), is a large tree-fern of the Eastern Himalaya and the Khasia Hills at 3–6000 ft., reaching 20 ft. in height and 6 to 8 in. in diameter. It is perhaps not distinct from *C. spinulosa*. (E 3423, Balasun Valley, Darjeeling, 5000 ft.; E 3424, Dumsong, Darjeeling, 5000 ft.) *C. Brunoniana*, Clarke and Baker *l.c.* (*Amphicosmia Brunoniana*, Bedd. Ferns 10, *Hemitelia Brunoniana*, Clarke *l.c.* 430; Gamble Darj. List 89); Vern. *Unyo*, *pakpa*, Nep.; *Pashien*, *pasen*, Lepcha, is a large tree-fern of Eastern Nepal, Sikkim, Bhutan and the Khasia Hills at 4–7000 ft. It is the most common species of the forests round Darjeeling, and the soft part of the interior of the stem is eaten by Lepchas. It reaches 30 and even 40 ft. in height and a diameter of 1 ft.

2. AMPHICOSMIA, Fée. *A. Walkeræ*, Hook.; Bedd. Ferns 8, is a tree-fern of the hills of Ceylon, common about Newera Ellia at 6–7000 ft.

3. ALSOPHILA, Br. Seven species. *A. latebrosa*, Hook.; Bedd. Ferns 11; Clarke *l.c.* 431; Kurz For. Fl. ii. 573; Gamble Darj. List 89, is a large tree-fern of the hill ranges of South India, at 5–7000 ft., extending north to Sikkim, Bhutan and the Khasia Hills, where it is scarce, and across the bay to the hills of Martaban. It is the most common kind on the Nilgiris. It reaches 30 ft. in height and a diameter of 1 ft. *A. glauca*, J. Sm.; Bedd. Ferns 12; Clarke *l.c.* 432; Gamble Darj. List 89 (*A. contaminans*, Wall.; Kurz For. Fl. ii. 573); Vern. *Pakjik*, *paludúm*, Lepcha, is a splendid tree-fern of the lower hills of Sikkim, Eastern Bengal and Burma. It is probably the largest Indian species, reaching a height of 50 ft., with a stem of considerable girth at the base, smaller above but widening again beneath the fronds.

These fronds are very large, often reaching 10 to 12 ft. in length, and the fern is easily recognized by its smooth rachis and leaves glaucous beneath. *A. ornata*, J. Scott; Bedd. Ferns 12; Gamble Darj. List 89 (*A. Oldhami*, Bedd.; Clarke *l.c.* 433; Bedd. Ferns 13; Gamble Darj. List 89); Vern. *Dangpashin*, Lepcha, is a pretty, often branching, rather small, tree-fern, not uncommon about Darjeeling at 5–6000 ft. *A. glabra*, Hook.; Bedd. Ferns 14; Clarke *l.c.* 433; Kurz For. Fl. ii. 573; Gamble Darj. List 89, is the common species of the plains. It is found in damp forests in the sub-Himalayan tract and Eastern Bengal, from Nepal down to Chittagong and Tenasserim, Central and Southern India, and Ceylon (*A. gigantea*, Hook.: Thw. Enum. 396). It is, however, rather a small species, rarely reaching, so far as I know, to more than 15 ft., though Clarke says it occasionally attains 50 ft. *A. crinita*, Hook.; Bedd. Ferns 16, is a tree-fern of South India and Ceylon reaching 20 ft. in height, and remarkable for its being densely covered with shaggy scales. *A. Andersoni*, J. Scott; Bedd. Ferns 12; Gamble Darj. List 89; Vern. *Pulai-nok*, Lepcha, is a scarce tree-fern of the Sikkim Hills. *A. albosetacea*, Bedd. Ferns 16, is a tree-fern of the Nicobar Islands.

4. BRAINEA, J. Sm. *B. insignis*, Hook.; Bedd. Ferns 395; Kurz For. Fl. ii. 574, is a tree-fern of the pine forests of the Martaban Hills at 4-6000 ft., with a stem 3 to 5 ft. high.

The structure of the stems of tree-ferns presents a great difference from that of either Dicotyledonous or Monocotyledonous trees. The appearance of the stem is usually that of a dark brown cylinder, marked above by regular scars, the bases of fallen leaves, and below by an entangled mass of fibres formed by the interlacement of roots. The inner structure is shown by a horizontal section to consist mainly of three portions: First, the outer layer formed by the bases of fallen leaves and interlacing rootlets; secondly, the cellular tissue which occupies the greater part of the interior; and, thirdly, the vascular bundles which form an irregular and cylindrically arranged ring inside the cortical layer. Each of these vascular bundles presents the appearance of a closed mass of curved, usually crescent-shaped, outline, having on the outside a hard black layer of woody fibres, and inside two light-coloured layers of soft tissue, chiefly containing scalariform vessels. When dry, the cellular tissue which fills the interior contracts, leaving usually a hollow space, the ring of vascular bundles then showing a wavy pattern of alternately light and dark layers.

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